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ABSTRACT

Twenty-five students who participated as Environmental Protection Agency summer fellows in 1972 were selected from among eight hundred applicants responding to a national recruitment program. The students chosen majored in a wide range of environmentally related studies on university and college campuses across the United States. Selected research topics were undertaken to bring fresh, hopefully unbiased, viewpoints on existing environmental problems in the anticipation that their contributions would suggest new avenues for the development of current long-range environmental strategy. The students, composing five investigative teams, concentrated their efforts on: (1) a possible approach toward quantifying the concept "quality-of-life"; (2) development of an accounting system for allocating pollution produced by industry as a result of consumer demands for goods and the environment; (3) investigating the realm of environmental management; and (4) how the generation of pollution differs as a characteristic of a community's location within large metropolitan areas. This volume, the first in a series, presents a synopsis of the full length reports published as separate reports in this series. (Author/BB)

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Studies In Environment -
Vol. I - Summary Report

Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

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STUDIES IN ENVIRONMENT

VOLUME 1
SUMMARY REPORT

by

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Grant No. 801473
Program Element No. 1HA098

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ABSTRACT

Twenty-five students who participated as EPA summer fellows were selected from among eight hundred applicants responding to a national recruitment program.

The students chosen majored in a wide range of environmentally related studies on university and college campuses across the United States. Select research topics were undertaken to bring fresh, hopefully unbiased, viewpoints on existing environmental problems in the anticipation that their contributions would suggest new avenues for the development of current long-range environmental strategy.

The students, composing five investigative teams, concentrated their efforts on: a possible approach toward quantifying the concept 'quality-of-life'; development of an accounting system for allocating pollution produced by industry as a result of consumer demands for goods and the environment; investigating the realm of environmental management; and lastly, how the generation of pollution differs as a characteristic of a community's location within large metropolitan areas.

This volume, the first in a series, presents a synopsis of the full length reports published as separate reports in this series. The other reports are: (Vol. 2) Quality of Life; (Vol. 3) Pollution and the Municipality; (Vol. 4) Consumption Differentials and the Environment; (Vol. 5) Outdoor Recreation and the Environment; (Vol. 6) Environmental Management.

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SECTION I
CONCLUSION

> The least that the EPA Fellows will achieve in their Summer 1972 research efforts is a state-of-the-art report; the most that they will achieve is the plowing of new ground.

So stated the Director of the Environmental Studies Division, Office of Research and Development, Environmental Protection Agency which funded the EPA Fellows Project administered by the Homer Hoyt Institute during the spring and summer of 1972.

The results were in accord with the charge given by Dr. House. A state-of-the-art report covering the five selected research areas has been completed and is being prepared for publication. Some new ground has also been plowed, especially in one of the areas which emerged from a study of pollution generated by consumptive sectors titled, "Consumption Differentials and the Environment."

The most significant points of each of the five studies are summarized in the five ensuing sections of this executive summary. This section is designed to give an overview of the project.

The provision of an overview provides a dilemma. On the one hand, each of the five general topics can be taken as targets of research opportunity of interest to EPA and others concerned with environmental research, without attempting to link the studies. On the other hand, one can take a holistic view and select some specialized and particular critical areas for analyses. The study did not attempt the latter. But with five general research topics, an overview should impute some connection as a context for each of the five component studies.

The five studies emerged as (1) Quality of Life, (2) Center-City-Suburban Pollution Differentials, (3) Consumption Differentials and the Environment, (4) Leisure and the Environment, and (5) Environmental Management. Subsequently, the center-city study focused on pollution rather than the broader quality of life within the center city, the differentials study started off as a study of the future of the environment and the leisure group focused on Outdoor Recreation. These adjustments were made in light of the productive capability of the 25 EPA Summer Research Fellows over an 11-week period.

The sequencing indicates a linkage. The first question, or study topic, relates to measurement of the quality of life as a tool for public policy purposes.

In the contemporary administration jargon, goals are translated into measurable objectives for which programs are developed and in which progress is monitored. The application of the techniques requires some measurement.

Measurement in the economic sector of society is less difficult than in the social or political sectors. Thus, when the Employment Act of 1946 was passed, the national policy of pursuing high levels of income, output, and employment with relative price stability was formalized. The Council of Economic Advisors was established to assist in the process. Part of that assistance was and is in the use of economic indicators dealing with income, output, employment, and inflation.

In more recent history national goals have focused on environmental concerns which have dimensions aside from the social and political sector as well as the economic sector. Included are natural environment and the "built" environment in the physical sense. The physical qualities are amenable to measure, though not without difficulty. Nonphysical and noneconomic conditions pose new and different problems. Even more perplexing is the handling of a multiplicity of conditions with the intent of some compositial indicator. The United States has a gross national product but not a gross social product.

The quality of life team (QOL) looked for QOL indicators which could shed some light on conception, definition, and measurement of these factors which would be of assistance in public policy areas. The emphasis was thus on societal priorities for policy purpose rather than on individual priority for spending matters, be it money, time, or whatever.

As the next section identifies in more detail, the QOL team reviewed the literature dealing with social indicators and especially on QOL itself. As a result, they have defined and classified quality of life factors. Measurement problems were approached by using objective and subjective measures with conversions to scalers, thus, combinations of indicators would be handled as composite indices.

The state-of-the-art review and synthesis makes a contribution toward definition and classification. The plowing of new ground is begun with the suggested techniques of measurement, especially composite measurement. Some field experimentation and demonstration would be a next logical step.

The quality of life indicators are aggregates of some population--it can be that of the nation as a whole or of state or local jurisdiction. The indicators may be used for one or combinations of sectors in large or small geographics. Comparison may be made among local areas for various policy purposes.

One particular type of contrast in the quality of life or environmental quality may be drawn on the basis of the differential between center-city and suburban locations. The state-of-the-art review covered measurements of environmental differentials between center-city and suburban locales for air, noise, water, solid waste, and radiation. Then, the team reviewed research which sought to link center-city pollution to polluters. The analysis then turns to federal pollution control and some views of the impact of uniform federal enforcement.

Linking pollution to polluters is a massive task which, although touched on in concept by the center-city team, was more fully explored by the consumption differentials team. Indeed, that team plowed new ground.

The consumption differentials team classified potential polluters by individual family unit divided by socio-economic status. Based upon the goods and services they consumed, the chain of production was traced to estimate the pollution generated. Thus, pollution generated is connected to consumption of product or service.

Leisure activity has been of exceptional concern in relationship to environment. Outdoor recreation as a leisure-time activity is of particular concern because it has a more obvious or noticeable environmental impact. The leisure team developed a state of the art report on five segmentized areas dealing with outdoor recreation on private land, public land, coastal areas, and urban areas. Additionally, they dealt with future recreation trends.

All of this suggests that improved management of the environment is not only a necessity but a fertile prospect. One of the difficulties in a complex, pluralistic, and free society is that of environmental management processes. And, in order to tackle that question an understanding of the various perceptions and practices of environmental management is particularly useful.

The environmental management team went after the perceptions with an attempt at a three-dimensional matrix which basically classified perceptions as legal, administrative, and theoretical. Subsequently, three interrelated levels of analysis and evaluation were developed, including the tools, functions, and structures employed by the existing variety of governmental agencies charged with the environmental management responsibility.

The following chapters present in greater detail the summary findings of each of the five environmental study areas investigated by the 1972 EPA Summer Fellows.

SECTION II
QUALITY OF LIFE*

"Discontentment with objective conditions [of one's total environment] has appeared to be increasing over exactly the same period that those conditions have at most points and by almost all criteria been improving, . . ." according to one author. Writers of the popular press diagnose various aspects of the problem as "future shock" or retarded "consciousness levels."

After years of vying for achievements, the American public has begun to question the relative value of what they have achieved. Dissatisfaction stems from different evaluations and reactions to conditions.

Assessments of quality of life are an attempt to measure the conditions of what has been achieved. However, the research team found no sufficient definition of the quality of life or specifications of the conditions associated with it. In addition, the team found no standards for what the QOL should be, and even if standards did exist the team found no way to determine if they were adequate standards for all Americans.

The omnibus task of defining and measuring the quality of life is an attempt to formulate a comprehensive methodology to validly assess these types of questions and problems. They agreed that the study should focus on the following aspects of the quality of life.

1. Those in which individuals have an active personal interest. (This stipulation was intended to exclude the difficulties which might be associated with identifying a national priority with an individual priority.

2. Those in which known or conceivable strategies of social organization (societal management) can influence the factor. (This stipulation was intended to exclude the problem of identifying personal priorities of individuals and reifying them to matters related to the Quality of Life for all persons.)

3. Those which have measurable objective and subjective features.

State of the Art

The state of the art was reviewed by tracing the development of social indicators and relating them to the current efforts to measure the quality of life.

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*The research team producing the original report was headed by Kenneth E. Hornback and included Joel M. Guttman, Harold L. Himmelstein, Ann B. Rappaport and Roy Reyna.

The Fellows noted several trends:

1. A growing interest in methodological rigor and a desire to compare and validate various research strategies;
2. An increasing emphasis on the development of standardized time series data and the expansion of federal statistical activities.
3. A growing emphasis on the collection and analysis of subjective data and the expansion of traditional areas of data collection.
4. An emergence of a clearer picture of what subjective data will be important, i.e., information on occupational status, time budgets, mental health, political participation, etc. However, these developments did not merge into one theoretical or methodological strategy.

Attempt to Develop Theoretical Perspectives

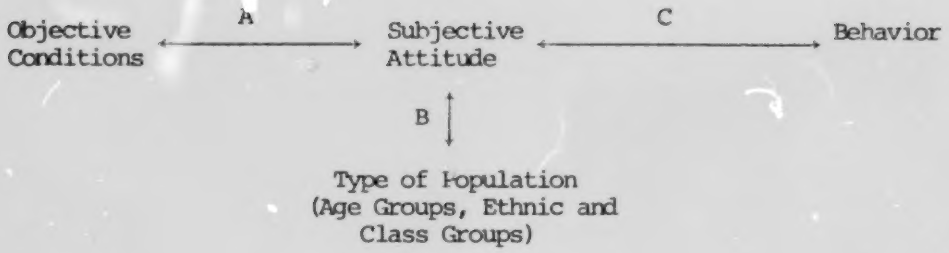
The QOL is defined as a function between objective conditions and subjective attitudes involving a defined area of concern.

Implicit in any discussion of the QOL is the notion of some area to which that QOL refers. An area may be defined according to the analytical purposes with consideration of data availability.

The Fellows defined objective conditions as numerically measurable artifacts of a physical event (e.g., air pollution in parts per million of sulfer dioxide); sociological event (divorce rates, crime rates, number of ethnic minority persons, etc.); or economic event (local consumer price index, municipal budget, costs of highway construction, etc.). Objective conditions may be defined as any number which stands for a given quantity of a variable of interest so long as it is independent of subjective opinion and reliable. (Substantially the same number results every time the event is measured.)

Understanding the specific meaning of subjective attitude requires a complex and lengthy discussion, so to avoid the confusion which often accompanies a concept used in many diverse contexts a definition of subjective attitude was evolved from the elimination of several definitions which would be inappropriate or unworkable in combination with the concept of QOL.

In brief, subjective attitude, as defined in the study, is primarily concerned with affective and cognitive dimensions. It is specifically concerned with how aspects of cognition vary as objective conditions vary. The terms utilized in this discussion and the focus of much recent research can be characterized as follows:



The QOL definition developed depends on an elaboration of the A relationship. The A relationship corresponds to the key term function in the QOL definition.

Proposed Quantification Scheme

The proposed quantification scheme is based on the assignment of objective and subjective values to a series of variables which are called QOL factors (e.g. income, social participation, air quality, etc.).

Various objective indicators for each QOL factor are discussed. (For example, the air quality indicator is a composite measure of air pollution characteristics.) In some instances, the objective measure is appropriate to a particular region (as in the case of air quality), in others it pertains directly to an individual (as in the case of income). Once objective measures have been obtained for each factor, they are transformed in the proposed formulation to a normal scale varying from 1 to 10 in which the value of 1 corresponds to the lowest, or least satisfactory measure (i.e. lowest QOL) and 10 corresponds to the highest. Such a transformation requires that appropriate upper and lower bounds be established for each variable.

For each objective measure, a corresponding subjective measure must be developed by rating the satisfaction a group may hold toward objective measure for each factor. Again, a 1-to-10 scale is used such that 1 corresponds to the lowest level of attitudinal satisfaction (i.e. dissatisfaction, dislike, unfavorability) and 10 corresponds to the highest possible level of satisfaction. Obviously the anchoring of this subjective scale is open to some question. How, for example, does one define the greatest possible satisfaction with one's working conditions, or with the availability of wilderness areas? A substantial amount of social research is required to determine if the subjective scales can be bounded in a meaningful way.

The next step is to combine these factors into a reasonable expression for a factor index which describes the state of that factor and its importance.

Careful identification of the population to be assessed for QOL is necessary. This population could be the whole sample population or some subset of it. In collecting data from individuals, information is also collected on 10 standard population characteristics (age, sex, race, income bracket, geographic location, etc.). These data permit an ordering of the objective and subjective measures for all factors in a matrix against population characteristics, and hence an evaluation of the QOL for a variety of different populations.

Under no circumstances should this approach be regarded as providing a perfect or immutable index of the QOL. It yields only a reasonable strategy by which research thinking can move to the next series of questions about the QOL, once data are available to show how the formula can be better expressed. The formula has several potential drawbacks including the likelihood that satisfaction and importance weighting are measures of the same thing.

Quality of Life Factors

The essence of this section is to discuss the merits of a suggested list of quality of life (QOL) factors for use as a guide in developing representative indicators. Generating a workable list of indicators is a primary step toward the eventual measurement of QOL.

Though the thesis of the QOL argument is that valid QOL measurement requires the use of both objective and subjective indicators, only the former are given in the text of this section. A discussion of an approach toward obtaining a representative list of subjective indicators, including examples, will be found as Appendix B of the original report.

The literature search revealed a number of studies with various QOL factor lists. These have been summarized and evaluated in the study.

The team generated its own QOL factor list by both inductive and deductive methods. Each team member listed the factors he/she believed should be part of any QOL index. These factors were grouped into larger sectors, each uniting a number of factors into a logical and nonredundant rubric. A reading of the QOL literature generated new factors under each of the sector headings. Each of the factors were broken down into subfactors in an attempt (a) to clarify the meaning of each factor and (b) to detect redundancies between factors. Such redundancies are undesirable because in the final QOL index they would cause double-accounting. If all of the subfactors of one factor were also listed under the heading of another factor, the former factor was eliminated. In cases of partial redundancy, factors were redefined to eliminate such overlaps. Finally, another search was made of the relevant literature to further refine the list of factors. The final factor sets are shown in Table 1 under six major headings.

The remaining discussion in this section summarizes the coverage of QOL indicators.

TABLE 1

QUALITY OF LIFE FACTORS*

Indicators

Major Factors	Objective Indicators**
1. Economic Environment:	
Income	Per capita disposable income Median family income
Income Distribution	Gini coefficient of income distribution
Economic Security	Income support Wealth measures
Work Satisfaction	Accident, productivity, and turnover rates
2. Social Sector:	
Family	Marriage and divorce rates Illegitimate births
Community	Social responsibility scale
Social Stability	Upward social mobility Social disorder incident rates
Physical Security	Violent crime rates
Culture	Human effort directed toward the arts
Recreation	Persons participating in outdoor recreation and average days per person
3. Political Environment:	
Electoral Participation	Percentage of registrants voting

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*Examples of the methodology for determining subjective factors is given in Appendix B of the original report.

**This is not intended to be an exhaustive listing.

Major Factors	Objective Indicators
Nonelectoral Participation	Bloomberg & Rosenstock's "Action Score"
Government Responsibility	Budget allocations Per capita distribution of funds
Civil Liberties	Rights commission Citizens review board
Informed Constituency	Content analysis of mass media
4. Health:	
Physical	Infant mortality Physicians/capita Health care facility utilization
Mental	Persons in mental hospitals/population Diagnosis of cause/population
Nourishment	Per capita consumption of food types Nutrients consumed per day per capita
5. Physical Environment:	
Housing	Percentage deteriorated houses Percentage lacking plumbing Percentage overcrowded
Transportation	Family costs Percentage budget allocated to construction and maintenance
Public Service	Cost of gas and electricity Frequency and coverage of services
Material Quality	Product life Automobile recalls Cost and frequency of repairs
Aesthetics	Litter, billboards Trees preserved and planted

Major Factors	Objective Indicators
6. Natural Environment:	
Air Quality	People exposed to substandard conditions Concentration of CO, No_2, SO_2
Water Quality	BOD, coliform count Turbidity, temperature, pH
Radiation	Percentage radioactivity in water, soil, people
Toxicity	Lead concentrations Cases of lead poisoning
Solid Wastes	Pounds/capita Amount recycled Frequency of collection
Noise	Community noise difference scale (under development)

Economic Sector. The economic environment may be defined as those aspects of the QOL which deal with the magnitude, continuity, and distribution of people's income, and with the welfare or "ill-fare" generated in the process of attaining their income.

Income is a factor in the economic sector in that it represents an ability to purchase material goods and services. A portion of income may be accumulated wealth and wealth may be converted to income. The income is primary in that it is more closely related to consumption of goods and services.

Income distribution is a factor because it relates to equity as being a good in itself. The benefits of rising standards of living relate, in fact, to how well others are doing, hence income distribution.

Economic security is the protection an individual has against loss of regular source of income. Such protection may be in possession of wealth or in the existence of some form of income support, public or private.

Work satisfaction is the excess of amenities over disamenities associated with an individual's job. Subjectives, as listed by an author, indicate the character of this factor. They are occupation, status, supervision, peer relationships, job content, wages, and other extrinsic resources, promotion, and physical conditions.

Objective indicators for the economic sector are available, in part, from government sources, especially from the U. S. Department of Commerce. Some additional sources and people are noted.

Social Sector. The broad scope of social environment is indicated by the factors selected: family, community, social stability, physical stability, culture, and recreation.

Family, as a social system is considered a factor although it is undergoing dramatic change. Measurement and value problems are of particular difficulty, but divorce and illegitimate births vary conceptually and indicate the character of this factor in the negative sense while time devoted to family functions may indicate the positive character.

Community as a factor relates to the need to belong and be accepted. Thus, the voluntary association constitutes an aspect of community and the nature and character of participation may indicate community factor concept.

Social stability is community solidarity. Social distances which are aspects of difference become significant in QOL when polarization results from strong disagreement leading to social disorder such as riots or other confrontations.

Physical security as a factor is the safety of the public from violent crime. Aspects include the institutional order within which daily lives are led as well as the protection which is required and afforded.

Culture is perhaps best indicated by the arts, fine and applied. Attendance at performance or time spent listening, viewing or otherwise participating is a factor as well as the quality of the experience.

Recreation encompasses a wide variety of outdoor and indoor physical activities ranging from bicycling to fishing and from bowling to table tennis.

Indicators for the social sector are somewhat more difficult than for the economic sector although a diversity of sources does exist.

Political Sector. Electoral participation is a factor in the political sector. It is the right and exercise thereof for representation in the government process.

Nonelectoral participation is another factor. It includes speaking or writing to a public official, signing petitions, and communications to others concerned by a letter to the editor or by talking with others who may be similarly concerned.

Government responsiveness to the public is a factor. The elements of this factor are outputs of the system such as regulation and delivery of services.

Civil liberties as a factor may include the inalienable rights guaranteed by the constitution and may be taken as an elector which stresses the dignity of man as well as the right of freedom and equality under the constitution.

Informed constituency refers to acquaintance with the issues. Of particular concern is the availability of information on both sides of an issue.

Indicators are not suggested for all factors, civil liberties particularly is omitted. Some problems of measurement of the indicators occurred, not the least of which may be that more may signify improving quality of life (as with nonelectoral participation), or it may signify a decline in the state of affairs and hence a decline in the quality of life (as in air pollution).

Health Sector. A widely quoted definition of health is "a state of complete physical, mental, and social well being and not merely the absence of disease and infirmity." The social aspects are covered elsewhere in the study.

Physical health as a factor refers to absence of disease and infirmity. Mentality is also considered as an element in physical health. According to the literature, mental health includes both mental illiness and mental retardation. The retardation is usually a condition resulting from abnormal development.

The nutrition factor was measured through dietary analysis of food intake. The indicator problems for nutrition are perhaps not as severe as those in the political sector partially becuase of the availability of data.

Physical Environment. The physical environment includes a set of climatic, earth and life related factors of which man is a part.

Housing as the locale of the primary social relationship of family life is an influence on the physical, social, and psychological development of the household members and is considered as a factor in the physical environment.

Transportation as a factor encompasses satisfaction and dissatisfaction based upon accessibility, including the elements of time, congestion, safety, and stress for those who travel. It also includes the dissatisfaction of those who are adversely affected by the transportation media because of its noise, pollution, or other effects.

Public service encompasses the utilities such as water and gas, as well as garbage collection and street cleaning. The degree of satisfaction is affected by quality of service.

Material quality refers to the satisfaction obtained from the quality of the objects exchanged for money. It is a value concept.

Aesthetic quality as a function of perception puts ugliness and beauty in the eye of the beholder. Wide agreement may exist, however, as to the gracefulness of a suspension bridge or the ugliness of power lines.

Natural Environment. Air quality is an element of the natural environment. Air pollution, an unwanted byproduct of civilization contains odors, irritants and toxic substances. The absence of air pollution is considered to be a quality of life factor.

The absence of water pollution is another QOL factor in the natural environment. This factor applies to water for recreational use as well as domestic use.

Radiation is another factor in the natural environment. Exposure to radiation can cause biological injury including genetic effects and cancer. Man-made radiation emissions include those from x-ray equipment, nuclear power plants, reactor fuel-reprocessing plants, and from electronic products such as microwave ovens and color televisions.

Toxic substances in the environment fall into three categories of concern: acute toxicity to humans, chronic toxicity to humans, and adverse effects on the natural environment.

Solid waste protection refers to the handling and disposition of refuse, trash, and other solid waste.

Noise or unwanted sound pollutes the natural environment and thus detracts from quality of life.

Analytical Dimensions

The study addresses the questions of the extent to which generalization may be made about people's quality of life, the extent to which those generalizations are limited (and what are the limiting factors), and how does the limitation influence the QOL index. Through this particularized understanding rather than through the generalized statistic progress is hoped for on the policy problems related to improving the quality of life.

The analytical dimensions are explained in five areas, the first of which is population parameters required to explain irritation in the QOL.

The population parameters discussed include geographic location, education, age, ethnicity, health, sex, political disposition, socio-economic status, life adjustment.

The second and third areas explored the use of QOL data matrices. The QOL factors are used on one axis, while the analytical dimensions are used on the other. Each matrix then shows the relationship between one of the factors and one of the population parameters. Collectively, the matrices could be examined for their interaction effects or for the clusters of highly interrelated factors of parameters.

The third analytical area explored was the use of time series analyses. The data are useful in answering questions about the direction and extent of change in the QOL.

Causality issues are the fourth area. The portion is what causal relationships are involved in determining high or low QOL. Only one treatment of causal sequences was uncovered in the literature search. It dealt with sequence/outcomes: family background/life chances; schooling/level of living; job/health, welfare; income/status, acceptance; and expenditures/ satisfaction, morals.

Policy Implications

The study directs itself to several questions related to policy implications.

1. How does a QOL index relate to other work in the field of policy analysis?

2. What might be the uses and the misuses of a QOL index?

3. What can be done to insure that the index will not be used in ways contrary to the intention of its framers?

Policy Analysis. The QOL index may be used in policy analyses in several ways:

- Assessment of the public's values and preferences, and of objective conditions,
- Analysis of the impacts, trade-offs, and net effects of a given action,
- Evaluation of the outcome of a policy or action.

The assessment of the public's values and preferences, and of objective conditions is amenable to analysis over time. Since measurements tell relatively little about the status quo whereas measurements over time may indicate emerging problems or other changed conditions. For example, a change in attitude towards a problem may be a significant changed condition.

The analyses of impact and trade-off would not improve the means of assessing the *magnitudes* of the impacts of a given policy, except insofar as the index *furthered* the development of a more comprehensive approach to social problems. However, they would be of significant value in judging relative *importance* of these impacts.

A QOL index could provide a focus for the emerging field of social experimentation and outcome evaluation. The general absence of laboratory conditions has provided a severe problem in the development of knowledge in the social sciences. A QOL index could ameliorate the situation, somewhat.

Computer simulations which attempt to summarize many of the aspects of socio-environmental system into a computer program with which students or policy-makers interact could be expanded to utilize QOL indices. Such models are highly useful educational and research devices which facilitate the grasping of complex issues. A QOL index could aid in this purpose.

A QOL index might spur the development of a unified social science. The perspective of the index is an interdisciplinary one in which multiple systems are related as they interact in a single focus.

Any QOL index would be composed of two types of numbers: those reflecting objective conditions and actual states of mind (e.g., the amount of air pollution and the actual degree of work satisfaction), and those reflecting the relative importance of such conditions to the individuals whose QOL is being measured. The first type of numbers are called indicators; the second, weights. For governments to try to bring the first kind of numbers into line with what society considers "good" is clearly laudable within the limits of society's choices. But it is equally clear that an attempt by governments to control the second kind of numbers--the weights which individuals assign to QOL factors according to their subjective tastes--is outside of the bound traditionally assigned to government activity.

Secondly, a QOL index could include anything that influences a community's welfare, but, as previous sections have demonstrated, the measurability of many factors is extremely limited. Among the hardest to quantify are those relating to freedom and justice--the extent of civil liberties and the responsiveness of governments to their electorates. An operational QOL index would probably have to leave out such factors, because of their dichotomous and hard-to-quantify nature. Without trying to change subjective weights, the QOL index would be treated as the single measure of a government's performance. With certain vital intangibles left out of the index, this would amount to the sacrificing of such intangibles--e.g., freedom and justice--in order to maximize the easily quantified factors. The result would be much like that of the first misuse, although the route to this second misuse would be slightly different.

Thirdly, a QOL index relates not to a government's actions so much as to a change in the attitudes of individuals. The QOL index is meant to register the people's preferences and concerns. The index is not meant to actually influence those preferences. Yet in a conformistic society, such as eventuality is quite possible: having a preference structure that does not conform to the average weights listed in the QOL index could become unfashionable. Such a development would tend to make the index rigid and limit people's indivuality, as well as destroy the whole purpose of the QOL index.

Guarding Against Misuse. One way of guarding against misuse would be simply not to measure the QOL. Other ways include:

1. Centralizing the measurement of QOL, without making the QOL index a mere tool to justify the status quo or an administration's past performance. For example, Senator Walter Mondale's proposal to establish a council of social advisors modeled on the existing council of economic advisors, might be implemented. These social advisors would be distinguished academicians in the fields of sociology, political science, and the other social sciences (economics would not necessarily be excluded) and would prepare an annual social report. To help insure that the QOL index not be used to the disadvantage of the "outs," the council of social advisors might be made directly responsible to Congress.

2. The actual measurement of QOL might be done by a research team as independent as possible from the main institutions of government.

3. The QOL measurement process must be made the subject of wide public discussion and periodic, formal reexamination.

4. The philosophy of the QOL index needs to be further developed, and both the public and the policy-makers must be fully aware of the limitations of a QOL index. This is the only way to minimize the choice that the index would be used to create conformity, or to justify the actions that ignore those hard-to-quantify factors--such as liberty and social justice--that may never find their way into a QOL index.

No claim is made that these suggestions would totally eliminate the dangers cited earlier in this discussion. They may, however, reduce those dangers to a level such that the potential benefits of a QOL index would outweigh the likely costs. Of the many issues raised in the report on QOL measurement, the problem of guarding against these dangers perhaps deserves the greatest amount of further discussion and research.

SECTION III
POLLUTION AND THE MUNICIPALITY*

This study focused on differentials in environmental pollution between center city and suburban locales. The objective was a state-of-the-art-report to provide some insights into the ramifications of uniformly enforced federal environmental standards.

Levels of Differentials

The research encompassed study of air, noise, water, solid waste, pesticides, radiation, and climatic changes. This chapter summarizes the results uncovered in the search for differentials in pollution associated with center city areas as compared with suburban areas.

Air. Air pollution is measured by monitoring both ambient air quality and point-source emissions. Ambient air is chemically measured at stations at scattered locations. Point-source pollution is measured at fixed points such as factories and at mobile points such as with motor vehicles. Measurement may be direct by using monitoring devices at the location or estimated by analyses of the amount and type of materials consumed.

The six elements of the atmosphere designated as air pollutants by the Environmental Protection Agency (EPA) are sulfur oxides (chiefly sulfur dioxide, SO_2, and sulfur oxide, SO): nitrogen dioxide (NO_2); carbon monoxide (CO); photochemical oxidents (usually measured as ozone, O_3); reactial hydrocarbons (HC); and particulates or airborne nongaseous materials.

Comprehensive measurement of pollution is expensive because such measurement should be periodic at diverse locations. Diffusion models (which are mathematical analyses of pollutant emissions, metrological conditions, and topographical conditions) provided estimates of spacial distribution of pollution as an alternative to measurement at diverse locations.

The research team reviewed studies of the Buffalo-Niagara Falls area and of the San Francisco Bay Area as well as diffusion model studies for five additional areas, Birmingham, Alabama; Boston, Massachusetts; Boise, Idaho; Indianapolis, Indiana; and Washington, D. C. The only other study reported was one of ambient lead in Cincinnati and Philadelphia.

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*The research team producing the original report was headed by Pamela C. Cooper and included Samuel J. Kursh, Jeanie Rae Wakeland, Margo Van Winkle and Mary A. Zoller.

Existing studies are not sufficient for generalized statements on each of the pollutants as to center city-suburban differentials together with the seasonal and other temporal variations. The Buffalo-Niagara Falls study indicates that the center city has greater pollution levels for sulfur oxides and suspended particulates. The study of the San Francisco Bay area indicated higher levels of carbon monoxide and oxident concentrations in the close-in areas than in the suburban areas. The ambient lead study used classifications of commercial, industrial, residential, and rural. These classifications are not synonymous with center city-suburban classifications; however, the commercial and industrial sections had the higher ambient lead measurements with the residential and rural having the lowest, especially the rural. The diffusion models of the five cities indicate that pollutants, sulfur oxides, particulates, and carbon monoxide were higher in the center city than in the suburbs.

Noise. Noise, technically described as vibration in an elastic medium, can be pragmatically defined as unwanted sound. The magnitude of such sound or the level of noise is measured in decibels.

The decibel (dB) is a magnitude measure which uses a logarithmic scale for quantity of noise. Since the human ear does not respond equally to all frequencies, scales have been devised to relate different sensitivity levels. The human ear responds best to middle frequencies rather than low or high frequencies. Weighted scales favoring the middle frequencies by reducing the effects of low and high frequencies are said to be A-weighted. Thus, A-weighted decibels (dBA) are used for noise measures when the primary concern is for people.

The studies of outdoor noise indicated higher levels of noise in areas of city housing as compared with suburban detached housing. The median noise level for daytime were 73.0 dBA compared to 50.9 dBA, and for nighttime 65.5 dBA compared to 44.2 dBA according to the Irving Hock study "Urban Scale and Environmental Quality."

Noise emanates from activities associated with various types of land uses, and noise levels are associated with kind and intensity of land use. Intensity and type of construction is as important as intensity and type of traffic.

Water. Additions to water which tend to degrade its quality so as to contribute a hazard or impair the usefulness of the water are considered pollutants. Water pollutants may be classified into eight categories (1) domestic sewage and other oxygen demanding wastes; (2) infectious agents; (3) plant nutrients; (4) organic chemical exotics, particularly insecticides, pesticides, and detergents; (5) other mineral and chemical substances from industry, mining, and agricultural operations; (6) sediments from land erosion; (7) radioactive substances; (8) heat.

Two reported case studies indicated concentrations of pollution at center city locations. One, a study of the lower Passaic River, covered data from fifteen stations including those in the Newark, New Jersey area. Total coliform counts were from 9,700 to 500,000 organisms per 100 milliliters (ml), a permissible standard is 10,000 organisms per 100 ml. The stations located in the Newark area showed counts in the 100,000's.

The fecal coliform standard is 2,000 organisms per 100 ml. The measurements indicated sharp increases to 50,000 to 60,000 organisms per 100 milliliters close to Newark. Dissolved oxygen (DO) concentrations should be up to 5 to 7 milligrams per liter in order to support fish life, but measurements near Newark are consistent at 1 to 2 milligrams per liter.

The biochemical oxygen demand (BOD) loading of the Passaic River was estimated at 17,000 pounds per day. This rate is the equivalent to the raw discharge of a population of 100,000 persons. Suspended solids were also estimated at a high level (47,000 pounds per day). The high coliform counts, low amounts of dissolved oxygen (DO), high biochemical oxygen demand (BOD), and heavy amounts of floating debris were all below the federal-state standards with the most severely polluted section in the river near the city of Newark.

The second case study was of the Hudson River, revealing a high degree of water pollution affecting New York City. Total coliform counts reached values in the hundreds of thousands per milliliter. Fecal coliform counts were found as high as 25,000 per 100 milliliters. Dissolved oxygen values were 2 to 3 milligrams per liter.

In addition to the two ambient water studies of the Passaic River ("one of the most contaminated waterways in the world") and the lower Hudson River (with "the characteristics of an eutrophic brackish lake"), the group also reviewed studies of drinking water.

The Public Health Service drinking water standard for lead is "not greater than 0.05 mg per liter" (or 50 ug/l micrograms per liter). The drinking water may leave the treatment plant in an acceptable quality but reach people through old distribution systems made with lead. The water found in inner city areas has had lead content as high as 920 micrograms (920 ng/l) compared to lead content of 20 ug/l elsewhere.

In an older community in Boston a 1972 study on drinking water content of trace metals revealed that in 29 out of 54 homes, the concentration of lead exceeded the standard. A 1968 Chicago study found only four samples where the lead content was above the standard but 20 percent of the water samples were found to have higher concentrations of lead than water at the treatment plant.

The National Community Water Supply Study also was reviewed. It surveyed 969 public water supply systems and considered the three factors of top water quality, adequacy of facilities and operations, and status of surveillance and maintenance of the system. Findings revealed that the quality of drinking water is decreasing as the water systems are growing older and are not upgraded. Excerpts from the original study state,

> . . . 41 percent of the 969 systems were delivering waters of inferior quality to 2.5 million people. In fact, 360,000 persons in the study population were being served waters of a potentially dangerous quality . . . . 56 percent of the systems evidenced physical deficiencies including poorly protected groundwater sources, inadequate disinfection capacity, inadequate clarification capacity, and/or inadequate system pressure. In the eight SMSA's studied, the arrangements for providing water service were archaic and inefficient. While a majority of the population was served by one or a few large systems, each metropolitan area also contained small inefficient systems.[1]

Considering the source of lead pollutants, the indication is that the center-city areas, having the older system, are getting lower quality water. This lead pollution is in addition to the general drinking water pollution problem and the pollution of ambient water.

Solid Waste. Solid waste, one of the most visible urban environment problem, is of particular concern to central-city residential locations. Inadequate sanitation and garbage removal were named as significant grievances by the residents of almost half of the cities surveyed by the National Advisory Commission of Civil Disorders.

A case study of Wilmington, Delaware, was reviewed to indicate the character of the solid-waste problem. That study covered four subject areas: solid-waste generation and collection, abandoned automobiles, street cleaning, and special pickups (used appliances, furniture, etc. too large to be handled during regular service).

The analyses of solid waste compared a poverty and nonpoverty areas. Indications were that the poverty areas generated more refuse per dwelling unit. This generation level combined with higher density indicated a more severe accumulation problem. Therefore, contamination became especially important because of side effects which could be generated.

The analysers of abandoned automobiles indicate that abandonment was greatest in poverty areas. Special pickup requests were also greater in poverty areas. Although the time between the pickup request and service were generally estimated to be a week or less, the special pick-up items as well as the abondoned autos generated side effects. They may serve as breeding places for rats and vermin. They may become dangerous play toys for neighborhood children. Salvageable components may be removed by scavengers leaving debris. And, the aesthetics of the neighborhood may be severely impaired.

No significant difference was found in the street cleaning aspect of the study. The research team took issue with the findings which were based upon a study which covered a period of only two months and measured tons of refuse collected.

Pesticides. In 1970, 4,045 injuries and 19 deaths were attributed to pesticide usage. While the statistics represent a decline in injury and death, the center-city resident seems to have a greater exposure to the pesticide hazard.

Pesticide differentials are indicated in the studies reviewed. Three of the four studies cited (Kentucky, South Carolina, Florida, and Hawaii) varyingly used income and socioeconomic group differences in classification. The Hawaiian study compared urban Honolulu with the small village environment of Lanai.

The Kentucky study was a survey of urban households to determine pesticide usage and user habits. Among the findings were the following: 43 percent of the group stored pesticides in the kitchen, less than one-third of the survey group washed hands before eating or drinking, 81 percent (196 of 293) used pesticide regularly. Only 15 percent purchased pesticide from technical stores (nurseries, chemical dealers, feed and seed dealers) where instruction on usage is generally readily available. The remainder of the group purchased pesticides from general merchandise stores, food stores, or drug stores.

The volume of pesticide used was greatest in the lower- and upper-income groups. The lower-income group usage patterns were believed to stem mainly from pest problems relating to housing conditions and solid-waste accumulation. Upper-income usage pattern was believed to be influenced by a concern for protection of ornamental plants and shrubbery.

The South Carolina study was conducted in Charleston using a sample of 196 urban families. The 121 white families. were in predominantly middle-class areas. The 75 nonwhite families were mainly from lower socio-economic areas of the city.

The survey indicated that 89 percent of the group made some use of pesticides, 33 percent used them at least weekly. Usage was greater. As in the Kentucky study, the majority of the pesticide purchases were made in nontechnical stores. The major problem of storage near food of medicine and no protection by gloves or washing hands after usage were indicated.

The Florida study was in Dade County. It measured residue concentrations of DDT, DDE, and dieldrin and compared their incidence in population classification derived by use of three social-class indicators: Hollengshead Two Factor Index, population density, and census tract median income.

Results of the study indicated that residue concentrations were associated with social class with greater concentration found among the poor.

The Hawaii study similarly sought out differences among populations as to pesticide residue (DDT, DDE, dieldrin, and BHC). The different populations in this case were people from an urban area of Honolulu and people from a small village called Lanai.

The study indicated significant differences for DDT and BHC concentrations with the Honolulu residents having the higher residues. The differences were not significant for DDE and dieldrin.

Radiation. Radiation is measured in millirems. A millirem equals 1/1000ths of a rem which is a unit of measure, "roentgen equivalent man," which reflects an absorbed dose in human tissue.

The most significant amount of radiation exposure to general population is from natural background sources and medical sources. Background sources include cosmic radiation and radioactivity naturally existing in the soil, water, air, and human body. These generally amount to 100 to 125 millirems per year. The medical use of x-ray fluoroscopes and radioisotopes generally provide an annual dosage of 60.95 millirems.

Current federal regulations call for a maximum of 50 millirems per year from all man-made sources excluding medical sources on an individual basis. The per capita standard (limit) for population groups is 170 millirems per year.

Nuclear power plants, although increasing in number in recent years, do not seem to be generating an excess of radiation resulting in pollution. A 1969 study of thirteen nuclear power plants concluded that the annual dose to population with a 50-mile radius of the power plants averaged about 0.01 millirems.

However, electromagnetic radiation is increasing substantially. Sources include micro-wave ovens and radar devices as well as AM, FM, and TV broadcasting.

One of the measurement methods is by exposure on power density and duration, e.g., milliwatt per square centimeter per hour. The American National Standards Institute has recommended that occupational exposure for frequencies between 10 MH_z and 10 GH_z (i.e., 10^6 to 10^9 Hertz) not exceed 10 mw/cm^2 for periods of 0.1 hour or longer. "Hertz" is one of several frequency measures. Power is measured in watts, and densities in watts per square meter (a milliwatt per square centimeter).

Various studies were cited with concern on two counts. First the levels of radiation which have already been reached, and secondly the biological effects of exposure to this radiation. Assessments indicate that the dosage is below the limits set but the extent of pollution is increasing and the long-term effects are unknown.

Climatic Changes. The city environment generates a "heat island" effect," which is a significant temperature difference between the city and its rural environments. Annual averages have been reported to be between 0.5° C and 1.2° C.

Two studies were reviewed, one was of Cincinnati, Ohio during August 1969 and the other of a heat wave in St. Louis, Missouri. The major concern is with man's physiological reactions which may be overburdened by the added heat.

The four major categories of heat-endured illiness are heat exhaustion, dehydration, heat cramps, and heat stroke. While the normal relationship between temperature and mortality shows a decrease in summer months, an urban heat wave markedly increases the number of deaths.

The high-risk groups are persons over the age of 65, low-income people in crowded or poor housing, and patients with certain diseases.

Health Effects

While the foregoing summary indicates some health effects, the state-of-the-art also revealed studies of health effects. A summary of the key findings follows.

Air. Studies indicate that air pollution exerts a significant effect on health by increasing respiratory illinesses. One study dealing with an acute exposure to high levels of sulphur dioxide (1,140 mg/m^3) indicated that 43 percent of the population reported symptoms of respiratory distress. Another study dealing with high levels of sulfur oxides, particulates, and oxides of nitrogen showed an increase among adults in bronchitis, coughs, and shortness of breath. Studies of children indicate those from areas of greater pollution perform less well on ventilatory function tests.

Other studies have measured increases in mortality as related to levels of pollution. A study in Chicago indicated that daily respiratory mortality increased as levels of SO_2 increase and socio-economic levels decreased. Researchers in a Buffalo study found an association between levels of suspended particulates and deaths from cirrhosis of the liver (with adjustment for alcohol dependency considered).

Another study considered air-borne leads together with other sources (e.g., food and water contribute to high lead concentration in the blood). High lead concentration contributed to serve anemia and damage to the brain and nervous system damage. A different study of lead levels in children in low-income neighborhoods indicated that black children had higher concentrations of lead in their blood than white children. Some but not all could be traced to consumption of nonfood items such as lead-based paints.

Blood-lead levels for adults differ between center-city adults and suburban adults, according to a Philadelphia study which compared adults living and working in the center city with those who live and work in suburbia. Policemen, a group which gets more exposure to lead-filled automobile exhaust than any other group in the sample, had the highest level of lead in their bloodstreams.

Noise. For most people the effects of noise relate to communication, distraction, and disturbance of rest and sleep. For some people the effects of noise are a loss of hearing. Discomfort is a first sign of noise deafness. Noise also alters the rhythm of the heartbeat, increases the level of cholesterol in the blood, and raises blood pressure. Workers exposed to high noise levels have a higher incidence of cardiovascular disease and ear, nose, and throat disorders, than workers in less noisy surroundings. Other stressful effects of noise are changes in secretion of endocrine harmones and in kidney functions. Continued stress may increase susceptibility to infection, gastro-intestinal ulcers, or high blood pressure.

Noise may also affect individual personalities. People working in noisy surroundings tend to be more aggressive, distrustful, and paranoiac. Effects of noise in the home environment were also cited.

No studies were noted that specifically dealt with health differentials resulting from different noise levels. However, the higher noise level present in the city-center imply higher probability of adverse health effect emanating from noise.

Water. The health hazard from polluted water has been considered so great that many public beaches have been closed. The avoidance of this hazard results in the loss of available recreation.

The health hazards from drinking water are not so easily avoided, or have not been. One study of 969 systems indicated physical deficiency in 56 percent of the systems. Of the 2,600 samples, 36 percent contained one or more bacteriological or chemical constituents exceeding the limits, 9 percent contained bacteriological contamination evidencing potentially dangerous quality of water, 36 percent exceeded at least one of the chemical limits, and 11 percent exceeded the recommended organic chemical limit.

In 1965 at Riverside, California, a location different from those referred to in the previously noted study, 16,000 people were affected by an epidemic of acute gastroenteritis in which 70 people were hospitalized, and 3 died. In 1968 another attack of gastroenteritis occurred, this time in Angola, New York. The town uses the same lake for sewage and drinking water, and the disinfection system failed. Other cities frequently instruct their residents to boil the water before drinking, cooking, and washing because of bacterial pollution.

A total of 53 waterborne outbreaks of infectious hepatitis were reported this century. A recent example occurred in 1969 when 60 percent of the Holy Cross football team was struck with infectious hepatitis as a result of ineffective cross-connection control procedure.

Heavy metals, such as lead and mercury, are health hazards in that toxic effects occur from accumulation in the body. While most lead poisoning occurs from lead-based paints, the effect of lead from drinking water sources should not be ignored. More cases of lead poisoning are discovered in older sections of cities because houses in these sections are more likely to have lead-based paint and pipes containing lead.

Solid Waste. In the absence of quantitative based studies, qualitative analyses of health effects of solid-waste pollution were utilized. Direct effects include those associated with the presence of rats and vermin. Indirect effects are psychological, and these may be of greatest impact when combined with other inner-city conditions.

One source estimates that between 60 and 90 percent of all rat bites occur in the inner city. The injuries result from the association of the presence of rats and the accumulation of solid waste which provides a breeding place for rats and other disease carriers. These conditions, in turn, precipitate the use of pesticides. Note was also made of the fire hazards from accumulation of solid waste.

Pesticides. Little data are available on the health effects of pesticides. However, one study indicates an impact in respiratory impairment and a positive association with certain chronic diseases.

Sources

The structure and character of the city has an effect on the generation of pollution. The state-of-the-art review sought out studies which would deal with the hypothesis that the internal structure of the center city is associated with the pollution of its environment. Underlying this review was the consideration that inner-city regulations to control the pollution sources on the same basis as suburban regulations might result in significantly differing impact in which the side effects might provide a cure worse than the disease.

Air. The primary source of air pollution is incomplete combustion of fossil fuels such as petroleum and coal products. The fuels are heavily used as energy sources for automobiles and industrial activities as well as for heating.

The intensity of the generation of the pollution is associated with the density of the pollution activities. Over 60 percent of the total air pollution is generated on only 2 percent of the land area. The center-city locale is the site of the emission of 67 percent of the carbon monoxide, 56 percent of the sulfur oxides, 54 percent of the nitrogen oxides, 63 percent of the hydrocarbons, and 53 percent of the particulates.

Heavy manufacturing (which includes steel, cement, and paper pulp) contribute emissions which amount to 22 percent of the sulfur oxides, 26.5 percent of the particulates, 23.8 percent of the nitrogen oxide, 9.6 percent of the carbon monoxide, and 1.2 percent of the airborne lead.

Industrial boilers emit two pollutants in significant quantities, sulfur oxides (17 percent) and particulate (11 percent).

Commercial and institutional sources (including retail establishments, office buildings, public buildings, and some light industries) emit pollutants mostly from their heating plants. They account for 3.6 percent of the sulfur oxides.

Municipal sources include utilities and solid-waste combustion. Power plants account for 49 percent of the sulfur oxides, 20 percent of the particulates, and 23 percent of the nitrogen oxides. Incineration and open buring of trash are responsible for 2.5 percent of the nitrogen oxides, 7.8 percent of the carbon monoxide, 5 percent of the hyrocarbons, and 3 percent of the particulates.

Mobile sources (autos, buses, aircraft, trucks, trains, ships, and off-road vehicles) contribute 64 percent of the carbon monoxide, 51 percent of the hydrocarbons, 39 percent of the nitrogen oxides, 4 percent of the particulates, and 2.5 percent of the sulfur oxides.

Residential heating units emit approximately 5 percent of the sulfur oxides and 1 percent of the particulates.

The percentages cited are national and therefore are subject to wide differences for local areas. Some pollutants are emitted in significant concentrations by geographical area. For example, 55 percent of the sulfur oxides are emitted from seven northeastern states.

Mobile emissions are closely associated with urbanization. The major cities of the West are newer than those of the East and because they have grown most with the automobile they have the greatest emissions on a per capita basis.

Air pollution is primarily an urban problem because the sources, stationary and mobile, are concentrated in the city. Differences reflect not only differences in fuels used but also differing densities which reflect differing development patterns.

Noise. Various types of activities were classified and reviewed with the conclusion that more noise is generated in the city by virtue of the nature of its activities, the density, and the process of building and rebuilding the city. The location of activities is, of course, of substantial importance.

Industrial and commercial activities vary widely in the amount of noise they generate. Urban areas, however, tend to have concentrations of such activities and therefore generate noise which is not contained within the site boundaries. The review discusses types of industry of some noises.

While industrial activities may generate a great amount of noise from a single source, commercial activities may have low amounts of noise on a per unit basis but the level increases with multiple sources. For example, a few people talking will generate noise at a given level. Additional people speaking at the same noise level when combined raises the total noise level. Hence, the degree of crowding or density affects noise level.

Among the noisest equipment is construction equipment. Construction activity by its nature is concentrated in urban and urbanizing areas.

The noise from vehicles is, of course, greater in the city with larger number of vehicles. Noise varies by type of vehicle and thus the center city-suburban differentials are affected by the type of vehicular travel. For example, subway trains are quite noisy compared to buses.

Aircraft flights generate great amounts of noise, the effect of which depends on the proximity of those who hear the noise. Thus, the flight pattern and location of the airport greatly influences the incidence of noise. The analyses indicated substantial impact of noise on residential areas especially those from heavily urbanized close-in areas.

The review indicated that the notable exception to higher noise levels in the center city versus suburbia is noise from domestic sources. Air conditioning and other appliances may be more prevalent in suburban homes than in center-city homes. However, some offset may occur from greater affluence in suburbia permitting the purchase of quieter models.

The natural environment of trees and grass will soften the noise level as compared to the man-made environment of hard-surface structure. As a result noise generated in the center city is dampered less than noise in suburbia.

Water. Municipal sewage and industrial wastes are principal cause of water pollution in highly urbanized areas. The combination of waste water sewers and storm sewers (found in some older systems) provides an overflow during storms and in some cases during other peak-flow periods.

Other major sources of pollution are urban runoff, sediment from construction, oil spills, and ocean dumping. The quality of drinking water may be impaired not only by the quality of the water going into the system, but also by the maintenance of the system and the material of the pipes through which the water flows.

Industrial process waste annually generate 22 billion pounds of BOD load of which one-fifth is discharged into municipal sewers. Between 1957 and 1968 generation of industrial BOD load increased 200 percent while the growth in industrial production was only 60 percent. This vast change indicates that technological processes are important factors in the amount of pollution generation, not simply increases in production. The review cites numerous cases of industrial waste pollution ambient water.

Municipal wastes are the second largest source of water pollution after industries. The problems include municipal waste-water-plant effluents, "combined sewer"[2] discharges, and urban runoff. The general situation concerning municipal plants is that 13,000 communities have sewer systems and of those 10 percent dump the wastes back in the rivers untreated and 15 percent provide only primary treatment.[3] In 1960 only 62.3 percent of the U.S. population was served by public sewers (27.5 percent had a septic tank or cesspool and 10.2 percent had nonwater carriage or a privy.) In the 1970 census, about 70 percent of the total all-year housing had public sewer connections. Many communities are still in need of sewage systems, while 25 percent of those that have them discharge partially treated or untreated wastes into receiving waters. The large cities tend to be the oldest ones with the historically unplanned and presently overloaded sewer systems. They exhibit the largest numbers of combined sewers and the pollution problems that go with them.

Urban run-off is a dispersed, or nonpoint surface of pollution. The range of pollutants is wide with total coliform counts per 100 ml having been measured from 40 to 240,000 and suspended solids from 26 to 36,250 mg/l.

The primary mobile sources of water pollution are oil spills and ocean dumping. Oil spillage has been ranked as the second most important source of pollution in the Chesapeake Bay, according to one authority.

Solid Waste. Studies on the sources of solid waste were not cited, but some reasoned conclusions were indicated. The complexity of the issues, particularly since generation and collection are interrelated, leave this area as a high priority for further investigation.

Pesticides. Pesticide pollution is clearly identified as to source in the sense that the demand for pesticide use is identified with the causes of usage. This, of course, is related to solid-waste collection.

Legislation

The federal authority designated to enforce the national policy on environmental control is the Environmental Protection Agency. This agency has responsibility for the six natural environmental categories defined previously; i.e., water, air, solid waste, pesticides, noise, and radiation (including solar energy). The technique through which this agency enforces the directive of environmental control is that of application of standards. These standards are then applied uniformly to the various geographic areas of the United States.

Before exploring the inherent difficulties of a procedure of uniform controls over environmentally distinct sections of the metropolitan community, a brief summary of the summarized legislation is in order.

Air. Air pollution legislation, in existence since 1963, has been modified in 1965, 1967, and 1970 to form the present Clean Air Act. Each piece of legislation represents a somewhat different approach to the control of air pollution.

The current approach emphasizes ambient air standards with state implementation. The standards are of two classes; primary standards which are maximum levels of pollution without health effects, secondary standards are levels at which no adverse affects are anticipated or known to exist. The six pollutants covered are sulfur oxides, particulates, hydrocarbons, carbon monoxide, photochemical oxidents, and oxides of nitrogen.

The states are responsible for implementation of the standards and have been requested to spell out plans for achieving the standards by 1975. The methods used include emission standards, transportation controls, and land-use controls. Unsatisfactory plans are returned to the state for revision. If EPA can not get satisfactory revision, it may draw up the plan for the state.

EPA has standards for mobile sources but does not, with the exception of hazardous emissions, have regulatory standards for stationary sources. Emission from stationary sources are regulated when the materials have no ambient level and when they create the hazard of increasing mortality or serious incapacitating disease. Regulation may require filtering or monitoring techniques.

Noise. The Office of Noise Abatement in the Environmental Protection Agency was established by the Clean Air Amendment of 1970. Additionally, the National Environmental Policy Act of 1969 will exert an effect on noise regulation in that noise is now a consideration of environmental impact.

Proposed legislation includes a Noise Control Act. Various provisions range from EPA to require labeling of household products and appliances to EPA set standards for aircraft noise.

Other federal agencies have policies which deal with noise. Included are the Department of Transportation (Federal Highway Act and Airport and Airway Development

Act), Federal Aviation Agency, the Department of Housing and Urban Development, General Services Administration, the Department of Health, Education, and Welfare.

Water. The Water Quality Act of 1965 requires individual states to draw up their own standards which when approved by EPA become federal-state standards. This act was preceded by a 1956 Federal Water Pollution Control Act which utilizes an enforcement conference process. Enforcement effectiveness with the early act was lacking. The Water Quality Act of 1965 attempted to expedite enforcement procedures.

In addition to the enforcement conference process, federal law aided the abatement of pollution by providing construction grants for waste treatment plants. These programs are operated in conjunction with the states. The direct federal responsibility exists for interstate and navigable water and where interstate sale of shellfish suffers from pollution.

The most recent legislation, the Water Quality Act of 1970, expands enforcement procedures available to the state and includes a section on the control of oil pollution, thus placing this problem under federal authority.

The proposed 1972 amendments to the Water Pollution Control Act utilize the idea of effluent limitations. The proposed Marine Protection and Research Act of 1971 provided for a permit system to control ocean dumping with EPA as the permit-issuing authority. Proposed amendments to the Public Health Service Act provide for the establishment of federal standards pertaining to drinking water and its source.

Solid-Waste. Solid-waste legislation has been primarily directed toward the development of solid-waste management techniques and providing technical and financial assistance to solid-waste management agencies.

Environmental Protection Agency programs relate to new collection vehicles, collection systems, containerization, and training programs. Other federal action in solid waste stimulates recycling through the use of tax-exempt bonds. Under this program, private industry may finance recycling facilities with tax-exempt industrial development bonds.

Pesticide. The Environmental Protection Agency exercises pesticide regulation through a series of acts including: The Federal Insecticide, Fungicide, and Rodenticide Act, as amended; the Federal Food, Drug, and Cosmetic Act, as amended; and the Clean Air Act.

These acts provide that pesticides shipped through interstate commerce must be registered with EPA; approval for sale requires manufacturer evidence concerning the purpose, toxicity, and effectiveness of the substance; pesticides approved for sale must be labeled clearly indicating ingredients, methods of application, and safety precautions to be observed; interstate shipment may be halted if the pesticide product is found to be hazardous to the public; production and use of pesticide may be halted by EPA; and EPA establishes pesticide-residue tolerance levels for raw food stuff shipped through interstate commerce.

Often federal authority includes Federal Trade Commission regulation of advertising of pesticides, the Department of Transportation regulation of the shipment of pesticides through interstate commerce, Food and Drug Administration monitoring of food for existence of poisons, and the Department of Agriculture prevention of introduction of pests into the United States and other activities relating to the control and spread of pests.

Pending legislation would provide EPA with authority to restrict pesticide usage by classifying and categorizing pesticides to regulate the disposal of pesticides and pesticide containers. The bill would also simplify procedures for suspension and cancellation of pesticides.

Ramifications of Uniform Enforcement

The ramifications of uniform enforcement of federal pollution control was explored with the result that some hypotheses were formulated. The paucity of previous studies simply produced too little evidence to reach conclusions.

The hypotheses--which were formulated by reasoning through the operation of the system--utilize such analyses as were available and may be summarized as follows: the application of uniform federal pollution controls would decrease the mortality rates in center-city locales; increase the population under age 10 and over age 50 in the center city; increase the birth rate in the center city; increase center-city transportation problems for the poor and aged; increase center city housing problems especially increase housing abandonment; decrease the labor force participation through increased unemployment, especially for the black population; increase regional and local out-migration over the long term; decrease center-city population density; increase particular regional center-city and suburban densities; decrease the absolute number of marginal industries; shift the economic base of the center city, thus creating several unemployment problems in certain sectors.

Implicitly an opportunity exists for obtaining the benefits of enforcement of pollution standards commensurate with the tolerable side effects. Since in the analyses the side effects of enforcement were substantially different from center city, seemingly each set of standards needs to be explored individually as well as a part of the whole.

Studies almost always end with the suggestion for further research. Of the five areas studied, the center-city-suburban differential may well be the area most in need of further research because of substantial uncertainty as to whether the cure in some cases may not be worse than the disease.

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[1] James H. McDermott, P.E.; Director of the Bureau of Water Hygiene, Safe Drinking Water, pp. 176-77.

[2] Combined sewers exist when waste-water pipes are connected to storm-water pipes, and they form one sewage system. When the system is overloaded by storm water, it overflows or bypasses the treatment plant and dumps raw or partially treated wastes into the receiving waters.

[3] "Primary treatment" removes only gross solids and up to 35 percent of the BOD. "Secondary" is considered minimal treatment and that removes 80 to 90 percent of the BOD. Needed: Clean Water, Environmental Protection Agency, 1972.

SECTION IV
CONSUMPTION DIFFERENTIALS AND THE ENVIRONMENT*

The commonly acknowledged problem of pollution was the focus of the EPA Summer Fellows study title, "Consumption Differentials and the Environment." The Fellows sought other than the popularized air and water aspects of pollution. They sought a unique and significant approach that would call attention to the real dimensions of the environmental problem, one that would "strike home" to all Americans. The Fellows subsequently determined that the focus of this particular study would be the consumptive nature of American society.

Previously, the problem of pollution in the United States had been approached from three basic perspectives: (a) overpopulation; (b) emerging and partialistic technology; and (c) the profit-motivated practices of the industrial sector of the economy. Each of these perspectives inherently suggested its own particular solution to the problem. For example, birth control measures suggested a solution to the problem of overpopulation; an holistic systems approach was and is advanced as a solution to the partialistic technology problem; and common-property, natural resources are seen as having a greater, higher-level call on them than just the profit-seeking motivations of the private business sector. Each of these concerns focuses on a particular aspect of the pollution problem. Each of them also calls attention to the multivaried dimensions of the total pollution problem, in addition to providing specialized insight. One can easily imagine, then, that pollution of the environment can be solved in "many splendored" ways.

Each of these three basic perspectives, however, fails to sufficiently address a more fundamental characteristic of the American people: the American being, searching for ever-higher standards of living, has shown himself to be an acquisitive, consumptive animal. For example, while the United States contains only about 6 percent of the world's population, it consumes between 40 percent and 60 percent of the world's resources. A variety of crises pyramid; fuel and energy problems are compounded by dependency on Middle-Eastern oils. Demands for energy rise disproportionately faster-much faster--than the ability to supply these demands. These observations lead to the realization that the problem of pollution can neither be properly nor completely analyzed and understood without taking into consideration the alarming phenomenon of consumption--defined here as the usage and disposal of energy and resources--that characterizes American society.

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*The research team producing the original report was headed by Mary Beth Olsen and included Ethan Bickelhaupt, Donnie H. Grimsley, Pamela Scott and Cherie Sue Lewis.

Major Phases of Study

Accordingly, the research effort of the EPA Summer Fellows materialized as a report encompassing seven major phases of the study: (a) a consumption model was conceptualized and developed in the introduction; (b) a methodology was proposed and subsequently utilized to handle the analysis; (c) data presentations were defined and categorized for modular incorporation; (d) a top-ten listing of consumer pollutants was presented and justified; (e) their consumption patterns were analyzed; (f) other areas of consumer pollution were noted; and (g) future considerations for research were presented in an advancement of a theoretical input-output model for household consumption. A discussion of each of these sections follows, including the presentation of the findings of the research.

The Production-Consumption Flow

In the early stages of the project, the Fellows felt a need for a vehicle that would conceptualize and coalesce the major aspects or parameters of research. Such a vehicle would be easily grasped, as a fundamental truth or given, and would act as a reference point or base for the research to follow. The production-consumption flow became that vehicle. A basic flow of goods, materials, and services exists in any society to serve the needs and the desires of the populace in terms of food, clothing, and shelter. As the society becomes more advanced and its basic needs are satisfied, the wish for certain desires replaces needs and expands to include, for example, recreation, education, cosmetic medical attention, and other personal services and goods. In American society, as in most other advanced, industrialized nations, this flow of goods and services to the consuming public constitutes the primary basis for the entire economy: The strength of the nation depends on and is judged by this higher complex and interdependent, interrelated system of products and services.

The flow of products divides into two basic segments, production and consumption. Production, the first segment of the flow cycle, begins with decisions regarding raw materials, the collection and processing of these materials, the industrial decisions to produce certain products in certain ways, the production of interindustry products and services, decisions regarding final production of consumer (rather than industrial) goods and services, and lastly, the final production itself of those goods and services. Thus the vast interindustry flows of materials and services such as buildings, equipment, machinery, and business services are all aimed at filling certain intermediate steps in the eventual flow of products and services to the consumer.

The connecting steps between production and consumption include the network of delivery (distribution) and retailing (marketing) of goods and services to the consumer, including final purchase of those goods and services by the consumer.

Consumption, the second segment of the flow cycle, involves decisions regarding product usage, the actual usage of the goods and services, decisions regarding disposal, and the ultimate disposal. In the aggregate, the various consumption decisions and processes constitute consumer demand, which provides effective feedback for the various production decisions. Figure 1 presents the total production-consumption flow. Insofar as this flow is the basis of the economy, it provides the most comprehensive approach to analyzing the problems of pollution. Figure 1 also presents, then, the production-consumption model.

The Model

The production-consumption model is composed of process, decision, and feedback components. Significantly, pollution results from every process along the flow. The first process, the collection of raw materials needed to make the product, encompasses the excavation of mineral and chemical substances, the cutting and removal of lumber, the commercial catching of fish, and other actions. Pollution from excavation includes such things as acid mine drainage, slag piles as a resultant solid waste, and pollution resulting from the operation of machinery and equipment, including pollution from the generation of electricity as well as from the operation of internal combustion engines. Pollution from harvesting fish includes oil-spill discharges from engine operations and solid waste discharges from boat operations.

The next process in the flow of goods to the consumer involves interindustry flows of materials which include the manufacturing of equipment, the construction of buildings and other structures, the delivery of agricultural products, the provision of business services, and the manufacture of intermediary products prior to the inception of production for final consumer demand. Pollution from the interindustry segment is characterized by typical air, water, and land pollutants from manufacturing, commerce, and construction, as well as agricultural pollution such as suspended and dissolved solids and pesticides and herbicides.

The next process is final production for the consumer. This process is defined as including only those activities and processes which result directly in goods and services flowing to a final consumer; interindustry flows are excluded. It includes pollution from the final production of goods as well as from final delivery services, such as transportation and construction of buildings for retail activities. The resulting pollutants include dissolved and suspended solids, organic compounds, carbon monoxide, and solid wastes.

The final segment of the flow includes the usage and disposal of goods and services by the consumer, and it is the first process in which pollution is directly attributable to the consumer. Usage pollution includes pollution from the use of residential water and land, domestic electricity, pesticides and fertilizer, automobiles and air conditioning. Usage pollution depends essentially on these factors: the frequency, mode, and completeness of use; extent or utility of product usage; and the product's quality or efficiency. Disposal pollution is the more obvious solid-waste generation. Product discarding includes, for example, auto, stove, and refrigerator hulks and other used consumer durables.

The second portion of the model is the decision component. The decision components of the flow divide into the two categories of production and consumption. Production decisions encompass (a) raw material decisions, (b) interindustry production decisions, and (c) final product decisions. Consumption decisions are (a) purchase-and-usage decision, and (b) disposal decision. Obviously little or no direct pollution is generated by these various decision components. However, these decisions are obviously just as vital in that they determine the type and amount of pollution that will be produced by and result from each of the processes. So, any attempt to solve the problems of pollution must be aimed at these decision points because these decisions may be regarded as the causes of pollution.

Significantly, the production-consumption model shows a shared responsibility for the resultant pollution. The raw material decision to strip mine coal shares the burden for pollution with the interindustry production decision to process and use electricity, among other things, with the decision of final product (i.e., delivery to the consumer and carbon monoxide pollution); as well as with the consumption decisions of the consumer, who burns the coal and creates particulate pollution and otherwise adds to the smog condition. The consumer decision to purchase ever-newer automobiles, works backward to the interindustry decision to produce steel, and earlier, to strip mine coal.

The third portion of the model is the feedback component. The feedback components consist of the (a) demand and (b) recycling feedback loops. Of these, demand is the more important feedback component. Consumer demand traditionally has been viewed in terms of the effects of purchase decisions only on the final product decisions. The model indicates quite clearly that demand feedback plays a greatly expanded role. Not only does consumer demand influence all the production decisions, but the production chain of raw material-interindustry-final product shows an interrelated dependency which explains that any given production decision also influences those production decisions that preceded it. The recital, and subsequent assessment, of responsibility in the coal-steel-auto example is based on the interactions of this demand-feedback loop. From consumer on back, all can be seen to share responsibility for the total problem of pollution.

Recycling, as the second feedback component, is the reclamation of raw material or intermediary product for productive usage once more. The solid waste which results after usage of the consumer item is a function of the type, frequency, and completeness of the usage method, as well as the quality of the product. Various wastes can be differentially reintegrated into the industrial system depending on the original quality and upkeep of the product, the various types of components (i.e., metals, woods, plastics, and other synthetics) used in combination to make the product, and differential technologies that are applied to the recycling process. An assessment of recycling potentialities would only partially include the ease (and cost) of recycling products. In addition, an emphasis on product quality would extend product life and thus economize on the energy power and other resources otherwise necessary to reclaim the recycled product to usable form.

In terms of application of the model, demand for goods and services begins with the consumer. His demand feeds back into the chain process and creates the other demands for intermediate goods and services and raw materials. And, to the extent that the purpose of production is to satisfy demand, demand stands unmasked as the effective cause of pollution. However, even through the model places the greatest emphasis on consumer demand as the effective causal agent of pollution, it reaffirms industry's and its accompanying technology's responsibility in the creation of new consumer items or new forms of consumer services. Admittedly, the model does not attempt to quantify in a specific manner the relative importance of each of these factors. However, it does more than nominal importance on the role of the consumer and his independent decision-making process.

Consumer demand is exercised in two dimensions: (a) the consumer originates demands to fulfill basic needs (food, shelter, clothing) in conventional forms, and original consumer needs stimulate production of new items to fill current needs in a better way; (b) as a result, convenience, price, and novelty, as engineered by new technologies and industries, tend to enlarge consumer markets and modify consumer demand through advertising. This new production and technology expands present consumer markets with lower prices and greater convenience, while advertising brings new products to the attention of the consuming public and helps to initiate other needs which it can supply. In a way, it creates and modifies consumer demand, and thus it ever sustains the repetitive flow of goods and services in the economy.

The question of who indeed is to blame for pollution and who is responsible for the environment is hotly debated. Arguments are based on the nature of biological systems, on the role of industry and economics in the society, on the morality of interference with individual freedom, and so on. Depending on the perspective, responsibility seems to shift from overpopulation, to industrial organization, to partialistic technology, to inefficient or nonexistent common property resource management.

This model, however, contributes a wider perspective and recognizes that responsibility for pollution and environmental malfunctions rests with decision-makers at all levels. This model, by centering on the entire production-consumption cycle, is able to focus attention on all the relevant factors contributing to the pollution. The industrial decisions to use particular production methods and materials, the effective control mechanisms for common property resource use, the increasing number of consumers, their mounting affluence levels (a function of rising incomes and assets), and their resultant mounting product demands can each be evaluated as to their influence on total pollution.

An example of a consumer product illustrates the model in use. Paper lunch bags versus steel lunchboxes serves as an illustration of this cycle of demand, production, and use. Assume, for the sake of simplicity, that consumers demand lunch containers, and that two kinds of lunch containers exist, paper bags and steel lunchboxes. This consumer product demand for lunch containers places decision demands on the final producers who must decide which type of container, paper or metal, will be produced. On the basis of marketing information the final producers decide to produce some appropriate mix of the two products. The final producers then place demands on the interindustry producers for equipment and machinery needed to manufacture the paper and steel which will go into them. These demands, in turn, place demands on the raw material producers and extractors for the wood and iron ore needed. Differential pollution is thus produced at each of the production processes, depending on the material.

After the consumer exercises his perogative of product choice, he then uses his lunch container differentially, perhaps only once or a limited number of times in the case of the paper bag but repeatedly in the case of the metal lunchbox. Finally, the differential matter of disposal, either through recycling or just plain throwing the container away, determines whether the demand for another lunch container does or does not reoccur. Advertising may affect or change consumer choice. The model shows that the flow of goods and services from raw materials to final disposal is not linear and static, but instead it is circular and dynamic and constantly adjusts itself through the mechanism of the various feedback loops.

Methodology Design

The methodology for the study of consumption differentials approximated an input-output format. The data dealing with the production sequence of the flow chart were obtained from previous studies by Ronald G. Ridker[1] at Resources For the Future, Washington, D. C. These studies began with an input-output model of the American economy developed earlier in the Bureau of Business and Economic Research at the University of Maryland under the direction of Clopper Almon. This model contains some 185 production sectors, 126 of which are attributable to personal consumption. The model defines these sectors as special aggregates of the two- and three-digit standard industrial classification (SIC) codes of the U.S. Department of Commerce. For each of these sectors, the material provided by Resources for the Future gives pollution emissions per dollar of output of each sector in the base year, 1967.

The model divides pollutants into the categories of air, water, and solids, and further separates air pollution emissions from heat and power generation and emissions from industrial processes. Air pollutant emissions factors for coal, gas, and fuel oil derived from several sources were used to calculate total emissions from heat and power generation for manufacturing sectors; fuel consumption information was obtained from the Census of Manufacturers (1963). For nonmanufacturing sectors emissions were applied to the output base of a particular sector to calculate emissions from heat and power generation. In a similar manner air pollution emissions coefficients from industrial processes were developed per unit of output. Finally, the combined coefficients for air pollution emissions of both types were provided.

To a significant degree the International Research and Technology Corporation provided the water pollution data for the RFF work in A Model for Strategic Allocation of Water Pollution Abatement Funds.[2] The data included emission factors, urban waste water, and runoff, and waste water from livestock.

Solid waste loads generated by particular sectors in 1967 came from information included in previous studies, such as one in which Combustion Engineering, Inc., developed solid waste coefficients by dividing waste loads by output base.

The core model was presented through a series of input-output equations. The equations represented total outputs (the 185 production sectors), intermediate and final demands. The direct and indirect requirements per dollar of final demand, in short a presentation of inter-industry transactions, were developed.

Basic Data

The basic data for consumption expenditures was taken from Expenditure Patterns of the American Family developed by the National Conference Board in New York in 1965. The National Conference Board (NCB) data was collected through a survey conducted by the Bureau of Labor Statistics of the U.S. Department of Labor to determine average annual family expenditures for the years 1960 and 1961. The survey is based on a representative cross-section of the nation's nonfarm population.

In working with the production-consumption model the Fellows reconciled the consumption categories in the NCB data with the product categories in Almon's "pollution from production" data in The American Economy to 1975.[3] On the basis of all information the Fellows painstakingly developed an original classification of sectors by product usage in conjunction with the NCB consumption categories, and they noted sectors which were not classifiable for further consideration.

After organizing the final consumption-production categories the Fellows calculated consumption patterns by groups. They decided to use proportions of the family budget spent on each of the ascertained categories to update these proportions to the year 1970, rather than use the actual dollar figures. Therefore the proportion of the budget spent for the consumer categories differential inflation in product categories would reflect the increased family income and the actual rate of inflation in the economy as a whole. The Fellows organized NCB data on consumption by different groups into its appropriate consumption-production category, and developed charts to show proportions of the family budget spent for the reorganized 48 product categories by different consumption groups in terms of region, age of head of household, and income for the United States as a whole for 1960.

The 1960 data on consumer spending compiled by the Bureau of Labor Statistics was the last complete survey which explored differential consumption patterns by the analytical groups chosen for the study, by region, age of head of household, and income. To develop 1970 proportions, a wide range of information sources between 1960 and 1970 were integrated into the updating effort.

Pollutant Categories

In the data presentations included were the data on pollution by each of the product categories for 12 categories of pollutants, under the three major headings of water, air, and solid waste. Water pollutants included biological oxygen demand, suspended solids, dissolved solids, phosphate compounds, waste water, and nitrogen. Air pollutants included particulate, nitrous oxides, carbon monoxide, hydrocarbons, and sulfur oxides. The solid waste category included no itemized pollutants. The findings showed that the top 10 (of 12) categories studied represented only 30 percent to 55 percent of all consumption expenditures, yet 65 percent to 90 percent of all pollution in each category. These percentages imply that efforts to combat pollution can and probably should be concentrated on those few consumer commodities that result in the greatest pollution. In general, agricultural products are the preponderant source of water pollution. Utilities, housing, and automobile products are the major contributors to air pollution, and they produce the bulk (80 percent) of the solid waste pollution. (Utilities, housing, and automobiles contribute primarily inorganic solid waste; agricultural products contribute primarily organic solid waste.)

Top Ten Consumer Pollutants and Their Consumption Patterns

Certain categories of consumer items reappear at the top of each pollutant list with significant frequency. Ten high consumer polluting industries are shown in Table 1

The categories depicted in Table 1 could be considered responsible for a major portion of pollution in the U.S. economy, and consumption patterns for these items must become the focal point in any discussion of reducing pollution by reducing consumption of highly polluting items

The Fellows examined consumption patterns for the three main classifications of region, age of head of household, and income in relationship to the top 10 list of consumer pollutants. In terms of income, the two highest income groups (over $10,000 per year) overcontributed to the pollution problem by their consumption of these 10 items. These two income groups, comprising 44 percent of the population, contributed an average of 65 percent of the total pollution for these 10 items. The two lowest income group, earning under $5,000 per year, containing 29 percent of the population, contributed an average of only 10 percent of the pollution. The consumer items that the lowest income group contributed the most pollution were food and shelter items (or necessities) while the highest income groups contributed the most pollution in insurance, apparel, autos, and toiletries (or, as can be surmised, the luxuries).

In terms of age of head of household, the group with heads of households 25 to 54 years of age overconsume compared to their proportion of the population. Especially high is the group with heads of households aged 35 to 54 which comprises 38 percent of the population but average 49 percent of the aggregate consumption expenditures and therefore contribute 49 percent of the pollution. Interestingly, the group with heads of household 55 to 64 years old balances neatly at 17 percent of the consumption expenditures and 17 percent of the population. The two extreme groups, with age of head of household either under 25 or over 65, both underconsume relative to their percentage of the population. The over-65 age-group is especially notable because it comprises 19 percent of the population and averages only 7 percent of the aggregate consumption expenditures. Food and shelter commodities are their major or highest proportional expenditures; for the 35 to 54 age-group, apparel, insurance, and toiletries are highest. Thus, if pollution is to be reduced through a reduction in consumption expenditures, attention should be focused on those groups who consume most heavily, or those in which the age of head of households are 25 to 54 years old.

The northeast and northcentral regions overconsume relative to their proportions of the population. Comprising 24 percent and 27 percent of the population respectively, they contribute 27 percent and 29 percent of the consumption expenditures and therefore those percentages of the pollution. The South, however, contributes less than its share of consumption expenditures. This fact may result partly from its lower median income ($6,445 per year versus $8,511 in the northeast and $8,242 in the northcentral region, and $7,976 in the West). Between regions the differences in proportional consumption expenditures are small, and differences in specific consumption categories are random. A more detailed analysis of consumption patterns yielded no additional information. The Fellows concluded that for a reduction in pollution by an alteration in consumption patterns, concentrating on income and age of head of household consumer differentials becomes more relevant than concentrating on regional differences.

The Fellows analyzed the consumption patterns of the top 10 consumer pollutants to assign responsibility for pollution both to decision-makers in production and to consumers who demand the final products. Viewed in this perspective one can reduce pollution (a) by changing production methods and materials and (b) by altering consumption patterns.

Analysis revealed that many polluting products are those which are essential to health. Thus any change in consumption patterns will have to take place among specific food substitutes rather than between food categories. Other high polluting products reflect the desire for comfort and economic security. To alter consumption patterns in these categories should be somewhat easier than in essential food categories, nevertheless such changes will be difficult even if they are deemed desirable because adequate substitutes would have to be provided.

Despite overconsumption by the higher income levels, in terms of policy-making the Fellows recommended that little consideration should be given to the consumption levels of either the very high and very low income levels because of the small size of these groups in relationship to the massive middle class America that significantly impacts the pollution problem. National policy must look to the causative forces if the nation is to reduce pollution levels by altering consumption patterns.

Analysis Limitations

The type of consumption-pollution analysis employed carried three important limitations. The first was the masking of highly polluting industries. The input-output analysis used is concerned with and emphasizes final consumer goods, the pollution by interindustry producers was distributed over those consumer items to which their production process contributed. In the paper, auto, and electrical energy generating industries, a major portion of their output is delivered to other industrial users and producers, and the analysis also attributes that portion of their pollution. The policy-maker is confronted with difficult assessments in the possible trade-offs in consumer items. Choices would be most difficult without elaborate evaluative mechanisms.

The second limitation deals with imports. Some U.S.-produced goods were exported, yet the pollution was not, in the sense that it was distributed over the total amount of goods purchased in the United States. Thus on some items, especially those heavily exported, pollution caused per dollar of item bought was higher than it should have been. Counterbalancing this ratio are the goods imported to the United States with a pollution counts recorded against them. If they balance each other, the net pollution effect is zero. However, this subject appears to warrant further study.

The final area of concern deals with the spatial distribution of pollution. One of the most important variables in pollution severity is the concentration or dispersion of pollution sources. If the pollution is dispersed over wide areas, the natural ecological system can more easily deal with the pollutants. Pollution problems are amplified by the concentration of pollution in small areas because concentrations and interactions of pollutant reinforce strains on the environment. Again, available data were inadequate to the task of this analysis because it dealt only with the total amounts of pollutants put into the environment by various industrial processes.

The study of the use of the product by the consumer was to be the second major component of the consumption model. However, a brief investigation of the categories of consumer product usage, water, electrical energy, and transportation revealed that the magnitude of the effort required to adequately evaluate pollution impact of consumer product usage was not within the capability of the research team because of time and resource limitations, not to mention the difficulty of obtaining readily available pertinent data. Notwithstanding, the Fellows developed a limited number of generalizations from these brief investigations but they could not adequately support them by thorough research. The Fellows reported these topics as requiring further substantiation by empirical research: They included residential and and household water consumption, household electrical energy consumption, and use of transportation systems by socio-economic classes.

The solid waste component of the consumption model was the final stage of the product flow. Solid waste generated in the industrial and agricultural production of consumer items had been taken into consideration in the production component of the model. The remaining part of the solid waste component left to be analyzed was that portion of solid waste generated by the residential sector. A survey of available research in the area of differential residential generation of solid waste revealed only a very limited amount of pertinent work. The Fellows could make no national generalizations. The nature of the research was such that it was not representative of the nation. Residential solid waste generation would be another propitious area for future research.

Other Considerations for Research

Other future considerations for research include a theoretical input-output model for household consumption. Such a model would suggest a means of assessing differential pollutants and their sources. The effects of household could be traced from consumer buying patterns through product utilization habits, with accompanying energy usages, to the eventual waste or disposal of the products consumed. In attempting to set up a consumptive model of pollution, the Fellows found one essential piece of information lacking, that of differential usage of products. Consumer usage, wastage, and disposal warrants much more study.

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SECTION V

OUTDOOR RECREATION AND THE ENVIRONMENT*

The work ethic is under challenge. Americans increasingly look to their nonwork lives to fulfill needs not met by the job. While to many the merits of continuous labor and accomplishment are devices and the capacity to obtain and and hold a good job is the test of participation in society, the shifts in emphasis and changing values underlies a leisure boom.

Some of the shift results from disenchantment with the repetitive piece-of-the-job work of an industralized society. The nature of the work is a strong influence on whether the incentive is for pay only or for such things as accomplishment, service, and status. And, many of those individuals who achieved a sense of identity in their work as well as pay are reacting against what in a contemporary society is considered as an excess of work.

The rise in leisure spending is an indication of the extent of the boom in the activities. For example, one report indicates a move from 1967 expenditures on recreation-sports equipment of $9.6 billion to a 1972 projected expenditure of $18 billion. Another indication of the boom is the increased participation in outdoor recreation. For example, the National Park Service visitor count moved from 140 million in 1967 to 172 million in 1970.

The increase in activity is associated with increasing population and increasing participation rates. There are also differentials in participation according to age groups. The younger groups are high participants, and in recent years the median age of the population has shifted downward.

Increases in leisure time also buoy up leisure activity. Reductions in the length of the work week, increases in paid holidays, larger vacations, and early retirement all foster increases in leisure activities.

The rise in personal disposable income has been another factor as has higher levels of educational attainment. Add to this the increase in mobility, and the resulting boom is obvious.

The impact of the boom includes a heavier demand on existing facilities and a demand for additional facilities. The potential strain on the ecological carrying capacity is an environmental concern. This study focuses on the relationship between outdoor recreation and the environment.

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*The research team producing the original report was headed by Benno Kimmelman and included Keith Bildstein, Paul Bujak, William Horton, and Mary Savina.

Outdoor Recreation on Private Land

The private sector is playing a major role in providing outdoor recreational opportunities for the American public. A wide diversity of recreational enterprise and environmental effects already exist.

Private forest lands provide substantial opportunities of which much of the public is unaware. Ample resources are available, but bringing such resources into use presents some problems. Some forestry firms have no objection to picnicing or hiking but are not prepared to provide support facilities for organized recreation, such as sanitary facilities and electric power. They are reluctant to charge the public for usage which is free or at under cost on public land.

Potential liability to visitors is another discouraging aspect to public use of private land. Additionally, some companies report substantial damage through vandalism. Apparently, the use of such lands needs to be managed.

Private camp grounds provide excellent examples of management, both good and bad. It is a blooming business. Franchised campgrounds with cross country reservation systems facilitate the rising use of such facilities. However, sometimes the industry of use and mode of use not only adversely affect the environment but also destroy the very benefits being sought.

Ski resorts, another booming business, have similar problems. The character of development required for ski resorts may be more damaging to the environment than, say, camping. Thus, the sophistication of design requirements is greater. The study examines several examples of problem situations and approaches.

The issues raised include ecological balance, and fiscal cost-revenue operations. Sometimes the issues are based on different value judgments and aesthetics; the question becomes one of whose costs and whose benefits. But action results from opinion stemming from activism of environmental groups and in some case state regulation.

Second homes provide a different dimension to recreation. The majority (63%) are used on a seasonal basis, while many (28%) are used intermittently throughout the year. A small percentage (6%) are used for retirement. The dimension differs because the home may be used in conjunction with other recreational facilities.

Second homes are generally within reasonable travel to metropolitan areas. The major difficulty seems to be that second home developments generally have the same problems that are found in urban settings. Some examples are discussed in the study. Public and private centers procedures are discussed.

Theme parks, amusement parks built around a unifying idea, are a recent development. Currently 12 such parks exist and at least 8 more are in the planning stage. Disneyland, the first such park in the United States, opened in 1955. Its attendance the first year was 3.8 million persons; In 1971 it was 9.4 million persons.

While not all theme parks operate on such a scale, the size is such that each of them exerts a substantial impact. The nature and extent of such impact is discussed with particular reference to Disney World, an enterprise in Florida which again is not typical. The discussion covers not only the internal provision of public facilities and disposal of waste but also the external impact on economic and community development.

In discussing the roles of private enterprise the study provides some recommendations for providing recreational opportunity without harm to the environment.

Outdoor Recreation in Coastal Areas

The problems of outdoor recreation in the coastal areas are inextricably intertwined with problems of intense population concentrations in the coastal areas. In 1970, 85 percent of the U.S. population resided in the 30 coastal states, and 49 percent of the population lives in the coastal counties.

Increasing demand is being made on what are already, in many cases, inadequate facilities. The study cites figures indicating substantial increases in use of recreational facilities.

Most of the demand is in the form of 1-day outings. Shorelines within a few hours drive of heavy population concentrations get some very high peak attendances. As might be surmised, the demand is highest on weekends and holidays.

The shortage of supply is related to the limited amount of suitable shoreline in proximity to the population and the fact that only a portion of suitable shoreline is unused by federal and state authority for public use. In some cases the public has no access to public beaches because of intervening private property.

The intense use of shoreline land leads to man-made changes along the beach that may result in erosion. In some cases substantial amounts of beaches are lost.

The environmental impact also results from the dumping of industrial and domestic waste into the water. Problems include those emanating from concentrated waste from chemical and thermal pollution as well as untreated domestic waste.

Improper use of motor vehicles on the beach may cause significant environmental damage. Dune buggies have torn away grass vital to dune ecology, and the noise has a disturbing effect on shore birds. Nesting sites and feeding ground are destroyed.

Intensive use of shore areas bring the urban problems such as those of trash and inadequate sanitary facilities. Because of trash may include unused food, it may create serious difficulties in the natural food chain for birds and other wild life. These problems are in addition to the usual water pollution.

Development of more shoreline already publicly owned would ameliorate some of the problems. Acquisition of more shoreline for public use, an approach which is becoming increasingly more expensive would also be of aid. But increasing the supply is not sufficient. More sound environmental management policies are necessary to protect the environment.

The study provides an example of a shoreline plan which includes industry and population distribution as well as agriculture and energy supply. All of the sectors are combined with a recreation cycle in a design to produce little pollution and a minimal effect on the environment.

Outdoor Recreation in Urban Areas

The review of the research on outdoor recreation in urban areas emphasized the inadequacy of outdoor recreation in urban areas rather than the environmental impact of the boom in the demand for facilities. The environmental effects discussed were mainly those of the beneficial effects of the parks and recreation with some related pollution problems.

Differential Participation Rates. Various studies cited indicate that the availability and usage of outdoor recreational facilities differs significantly among various locations in the urban area and among the population groups with such factors as income, age, and sex. The analyses problem are confounded by a variety of measurement problems.

The standards generally used are inadequate. The most common measurement of acres of land in recreation, acres per capita, and number of acres deal with a physical supply without a quality measure so that the availability of the service is not quantified. For example, the services of a crowded playground differ substantially on a per acre basis. The addition of money invested per capita is of some aid, but the measurement of availability of services is still deficient.

Attempts have been made at development of city recreation and accessibility indices, but these have been frustrated by methodological problems especially data collection and classification. Notwithstanding these problems some measure of availability was possible.

The result is that the center-city resident has relatively little outdoor recreational opportunity as compared with the suburbanite. Part of this difference results from the competition among alternative land uses. Recreation land-use stands its best chance where the land in question has been rejected for other uses (usually because of its physical characteristics affecting developability). Thus, the most valuable close-in land is least likely to be used for outdoor recreation.

The demand for urban recreation is commonly measured in terms of population size, need (as reflected in desire), and participation. Measurement problems have led most studies to use population and participation rates. The state of the art review, however, emphasizes the need and desire.

Among the findings are the following: Population shifts while providing a relative decline in population totals for central cities has increased the concentration of poor, old, black, and one- and two-person households in the area of low availability of public outdoor recreation. Low-income families generally have low participation rates for most of the outdoor recreational activities. The more densely populated areas generally use the recreation areas more intensely and the nature of use varies with the character of urban location.

Using present participation to assess potential usage becomes quite difficult. If supply is dealt with in physical terms of facilities and demand in use of facilities then demand exists only when supply exists. The difficulty is that latent potential use, particularly in differing recreation forms remains latent. The study indicates that neither design of parks nor personnel are really attuned to the market.

The studies discussed concern the nonresponsiveness of parks to contemporary needs and the presence of problems such as crime. The underutilization is thus not simply a disinterest in parks and recreation but possibly a case of inadequacy in services available.

Environmental Impact. The study discussed the environmental impact of the urban environment on the people who live in the city. It emphasizes the relief provided by recreactional land. The study also discusses the impact of the urban environment on recreational land.

Impacts noted include: Snow-removal based on salt and other chemicals which adversely affects soil and trees; additional damage to trees from vandals, motorists, and maintenance crews; additionally the "heat island" effect of heat-absorbing building materials. Beneficial impacts included the contributions of urban vegetation to air quality and the reduction of noise levels through use of green spaces. Urban vegetation may also assist in controlling water pollution.

The section concludes with some recommendations for alleviating the current situation of generally inadequate urban recreation facilities. The recommendations deal with more equitable distribution of available recreation services and other aspects implicit in urban management as well as the need for further research.

Future Recreation Trends

Future recreation trends indicate a difficult process of balancing an increasing number of participants with the environmental considerations. All of the factors contributing to recreational demand--leisure time, education, disposable income, population growth and mobility--are forecasted to increase and will result in increased participation.

Demographic Factor. Population projections of the Bureau of the Census indicate population increases from 1970 to 1980 by 16.9 percent under Series B assumptions and 11.3 percent under Series E assumptions. The increase to the year 2000 is projected at 58.4 percent for Series B and 31.5 percent for Series E.

In either case, unless the supply of facilities is greatly expanded or the access to facilities is severely restricted the number of participants and intensity of use may threaten the reusability of the recreation resource. The increasing populations intensifies the problems of congestion and ecological damage.

The extent of the impact of the numerical increases is influenced by the age distribution. The effect is difficult to assess. However, one analysis points to the negative effect of increased age upon the participation so that the Series E projections infer substantially less of a public than the Series B projection.

Irrespective of the series used, the assumptions generally used are an increasing population concentration in metropolitan areas. The concentration is forecasted to increase from 71 percent in 1970 to 85 percent by the year 2000. The metropolitan areas of high concentration are particularly susceptible to increasing numbers. For example, in 1970 44 percent of the population lived in metropolitan areas of 1 million or more. The Series B projection indicates an increase to 65 percent by the year 2000 or 63 percent under Series E.

The consequences of such increases are related to the already heavy demands in the areas of heavy population concentration. Because many of these areas are along the coast and hence the increasing coastal problems are intensified.

The studies indicate that professional and white-collar workers with advanced education and with associated incomes are the most active outdoor participants. Since professional and technical jobs are expanding twice as fast as the total labor force and education and disposable income are on the rise, the expectation is for substantially increasing participation rates.

Increased Leisure Time. Increased leisure time obviously affects the demand for outdoor recreational facilities. However, the form of the available time is of substantial consequence.

Increased time at the end of the day provides some opportunity for additional outdoor recreation. However, increased blocks to time such as a 3-day weekend create a substantial change in recreational facilities requirements.

The federal legislation on Monday holidays has provided most industries with a 3-day weekend 5 times during the year. This 4-day week for 10 percent of the year has produced a substantial effect on leisure travel.

Moves to the 4-day week as a standard practice are already evident. Typically it is a rearrangement of the 40-hour week into 4 10-hour days rather than 5 8-hour days. Organized labor, however, is looking for the 5-day, 32 hour week.

One study on effect of the 4-day week was based upon interviews with employers at 13 firms during July and August 1970. In the sample, all free-time activities increased during the longer weekend. The most significant gains were in the participant activities (travel, fishing, and hunting, athletics, swimming, and boating). The striking increases were in travel (152%) and boating (319%).

Obviously, the study provides only one clue to the potential use and it is not sufficient for generalization. The other considerations are for time of the year, locality, and the like as well as the nature of the 4-day week. Alternative patterns of what 4-days may exert substantial effect on the intensity with which facilities are used.

Other aspects of increasing leisure time are increased vacation time and increased number of holidays. Some collective bargaining contracts are providing 5 and 6 weeks of vacation for long-service employees. Plant shutdown between Christmas and New Year's are also increasing as are the number of paid holidays. Some unions have gotten up to 13 and 17 paid holidays.

Early retirement is another boon to increased participation. Some contracts have early retirement with full pension benefits at age 56 with 30 years of service.

Not all recipients of lessened work time requirements opt for recreation as compared to work. Some get second jobs or increased time on second jobs they already have. But, the stage is set for an increase in participation of substantial magnitude, and much of it may occur in the most extensive-use time which is hardest on the ecological balance.

SECTION VI
ENVIRONMENTAL MANAGEMENT*

Environmental management is one of those deceptively simple terms that unfortunately, conjurs up innumerably different connotations in different people. As a result, contemplations and discussions of the concept lead researchers down a rose-colored path to a bewildering array of environmental as well as managerial concerns. For example, does environmental management mean unidimensional administrative management by one public agency over one component of natural resources, such as water quality control? Or, is environmental management multidimensional responsibility for all natural resources that cuts across all public regulatory and other governmental bodies at all levels of local, regional, state, and federal participation? Just exactly whose responsibility is it, and what exactly does it cover?

Disciplinary Viewpoints

Conceptual considerations such as these were among the most difficult early aspects of the environmental management study. The EPA Summer Fellows basically determined at the outset to define environmental management. This definition was accomplished partially by identifying and examining who was performing environmental management, and what their roles were. Accordingly, the viewpoints of ecologists, economists, systems analysts, political scientists, and legal theorists were reviewed. Reference sources and materials were identified and collected in order that, at a minimum, the background state-of-the-art on the subject might be documented. The state-of-the-art was the first purpose, and accomplishment, of the summer study.

Data collection and synthesis as well as continual study and analysis of the diverse materials produced many mentally frustrating periods. Intensive grappling with interpretations of the term environment management--including concepts of the Fellows as well as those of the "experts"--along with its appropriate range and depth of content, hightened these frustrations. They sought an analytical breakthrough but it was always intermingled with other highly personal frustrations inherent in the 24-hour resident, small, research-intensive group process that was situated in a rather idyllic, pastoral campus setting within the city confines of Washington, D. C.

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*The research team producing the original report was headed by Larry A. Nelsen and included Robert Blacksberg, Michael Freemark, Karn Otteson and Katherine Platt.

Definition

An early and most challenging purpose of the youthful, five-person research team was to structure an analytical framework as a classificatory beginning for later evaluative efforts of environmental management. Within the obvious constraints of an 11-week summer program and the limitations of available manpower, the Fellows logically determined that the research design should be limited and defined. Accordingly, they defined environmental management as the guidance, direction, and control by the government of the use of natural resources through the employment of certain tools, and environmental concerns were viewed as the basic categories of natural resources: air water, land, biological systems, minerals, and energy). Management was clarified as the role public responsibility, including local, city, county, substate, state, interstate, and federal administrative structures.

The approach taken by the authors was a theoretical and yet present-day definition of environment management, one that would be logical, consistent defensible, and operational. They defined an environmental manager as any public figure who had power or authority over certain elements of the natural resource environment. This definition could readily guide their classification of present-day environmental management efforts because it specified a set of activities which came under the authority of the environmental manager.

Classification Schema

To carry the methodology from classification to analysis and evaluation, the Fellows sought a means of linking environment and management together in a conceptual system of environmental management. They determined that the tools employed to carry out the public responsibilities of environmental management provided this link. These tools include the courts, economic measures, regulatory requirements, public investment and grants, and interagency requirements. Thus environmental concerns were joined with public management structures through the "tools" of environmental management, thus creating a three-part classification scheme for study organization and subsequent component analysis.

In further clarification and development of the classification scheme, the Fellows determined that the environmental concerns of air, water, land, biological systems, minerals, and energy controlling three types of impacts were: (a) residual and adverse impacts; (b) supplies, consumption, and beneficial impacts; and (c) resource recovery, recycling, and restoration (uniquely labeled the four R's). The public management structures included and embraced city councils, managers and mayors; county boards of supervisors and county executives; local departments and agencies; state governors, commissions, agencies, superagencies, boards; federal, presidential, and congressional offices and agencies; and local, state, and federal courts. The environmental management classification of tools stipulated the dimensions of the variety of actions of the courts, economic and regulatory measures, public investment and grants, and interagency measures. Together, these three descriptive dimensions--that is, environmental functions or concerns, public management structures, and the array of adhesive, managerial tools--combined to form the classification table. All of these component parts constituted the first level of evaluation.

Levels of Evaluation

Each report was to make three levels of evaluation and each level was to raise the analysis of environmental management to an even higher degree of sophistication. At the first level of evaluation a three-dimensional table was formed which listed on one axis the governmental structures (or agencies) responsible for the job of environmental management; on the second axis the tools which the environmental manager could use in managing the environment; and on the third axis the functions (or responsible concerns) of the environmental manager, including, for example, air pollution control or land-use management, without the broader and basic environmental (natural resource) caregories of air, water, land, biological systems, minerals, and energy. The classification table represented a new approach in ordering a logical framework to assist in the subsequent evaluation of environmental management programs.

Specifically, however, the evaluation needed a standard against which present-day environmental management efforts would be measured. After great difficulty, the Fellows determined that the definition of environmental management needed amplification to describe a desired state or goal of "what should be," rather than merely "what is" or what present exists. Consequently the term envirological management came to describe the state of what environmental management should achieve. They established five criteria as objectives which the environmental manager must balance in order to achieve envirological management. These five criteria are human health, economic growth, social growth, ecosystem balance, and aesthetics or amenities.

Unfortunately, time did not permit the examination of particular combinations of all entries of the three dimensional table. Thus the reader would not know exactly how well local health department control of air pollution through damage taxes would work, but he would learn something about local health departments, air pollution control, and damage taxes. He would also have a frame of reference with the triad base of structures, functions, and tools to later begin his own analysis and evaluation.

Findings of the Study

Overall, the classification table worked reasonably well. It provided a coherent ordering to the dimensions of environmental management. However, entries comprising the tools dimension required greater refinement than was accorded to them in the study. A more discrete delineation would immeasurably aid the more sophisticated tiers or levels of evaluation to follow. For example, many different types of incentives, with many degrees of application, are available to a superagency (i.e., a state environmental protection agency) to control energy consumption. Yet the study did not provide a greater refinement of given incentives as they were identified in various environmental programs. For many of the broader-category tools, subdivision of an entry would be recommended for sharper focus and clearer analysis. As an indication of the complexity of the succeeding levels of analysis and evaluation, however, the addition of one new entry adds 500 cells to the table.

With respect to the evaluation of structures, greater variability exists among governmental agency formations, whether state-to-state, locality-to-locality, or agency-to-agency. Thus, authority and responsibility vary, as does capability and subsequent performance. Measurement and judgment is necessarily general rather than detailed, for examination of these structures in all of their ramifications had to be limited. Therefore general characteristics are noted rather than specific ones.

The classification table acted merely as a guide to actual evaluation or the testing phase rather than as a detailed set of procedural specifications. Consequently evaluations were unstructured and subject to little control. A failure resulted in adequately assessing the validity of the testing process, and hence called into question the validity of the evaluations themselves. Subjectivity of judgment softens the contribution of the report.

In particular, the study failed to focus on specific environmental program elements in the testing phase interviews. In fairness, the research design stipulated the unstructured, random, open-ended interview. Thus, the testing process was not subject to validation. While the

Fellows were reasonably sure that the classification table itself works well on the basis of general design, they could not confirm the statements made in the evaluation of the tabular entries, the "cuts," or the cells.

In terms of study methodology, obviously much is to be desired. Grasping concrete results is difficulty. Yet, the subject of environmental management itself is incredibly broad, wide-ranging, and complex, and deserves a fresh, thoughtful approach. Admittedly structuring a comprehensive evaluation--not an evaluation of one agency or one program or one function or task--but of the entire subject is certainly not easy. In this regard, certain other findings of the study may also be useful.

The study revealed that generally environmental managers performed their tasks with some success. However, given America's pluralistic society in which each person performs certain specialties with specific responsibilities aggregating into an uncoordinated whole or total picture, the results of environmental management are also foreordained to fragmented effectiveness. In this manner the environment is no different from any other management subject. Its piecemeal management efforts dealing with piecemeal problems achieve, at best, piecemeal solutions.

Depending on the grasp and scope of the particular environmental manager, managerial performance ranges from the standard carrying out of the specific environmental mandates and tasks assigned to the creative interpretation of the agency and environmental responsibility. To the extent that the particular environmental manager has his own shop under control, he can engage in a broader style of management encompassing longer-range strategic and anticipatory planning. He can adequately prepare his agency for the necessary coordination with others' roles in related environmental matters and can marshall the full scenario of plans and resources which gives coherence and direction or a fuller meaning of mission to his agency.

However, the Fellows found that the subject of environment is rather a new phenomena. Similarly, the bureaucratic structures that have arisen to carry out the mandates of the new legislation dealing with environmental problems have ill-defined lines of authority and unclear responsibilities. Managerial creativity takes on a new meaning, and a difficult one, when interpreting an agency's specific environmental responsibilities. The age-old bureaucratic phenomena of a youthful agency struggle for power and influence contributes to this unsettled condition. Control of environmental programs means receipt of funding and staff build-up. It also means assumption of leadership in the respective expertise fields.

Similarly, federal responsibilities for the total environment are relatively new, or at least they appear so to many persons involved. Therefore, the Environmental Protection Agency has been known to reverse positions on particular matters in its evolving search for rulings of lasting wisdom. After all precedents to use as guidelines for current decisions are somewhat lacking. Unfortunate impacts on the state and local level include time and money loss and energy drain as local environmental work are aborted. The search for answers, however, is a mutual search; no one is especially sagacious.

Moreover, a crisis-type response to environmental problems exists at all levels of government. Newly drafted regulations are the palliative employed to "solve" crises-type problems. And, overreliance on regulatory-type tools sometimes hampers the search for solutions. For example, in the case of housing as a land-use concern, locally-drafted rent-control measures are increasingly viewed as a "solution" to a quality-of-life environmental problem. The newly adopted ordinance acts as a palliative rather than a remedy for an imbalance in the basic economic equation of demand and supply in housing.

At a minimum, hopefully the rent control ordinance will serve as a short-term public control on an environmental resource, and buy time for a deeper study of the issue and a subsequent planned proposal that more adequately corrects the structural imbalance of the complex urban system. For the moment, however, environmental managers are human beings and subject to the community and political pressures that crescendo as environmental crises.

The fellows observed particularly strong animosity between the states and the Federal Government on the matter of regulatory-type tools. Deadline-dates for meeting national standards are proposed, without adequate consideration of the specifics of implementation. Issuing a decree is one thing, carrying it out with a reasonable correlation with reality is another. Action programs of whatever nature are subject to practical limitations and constraints, especially at the lcoal level, and these need to be identified and quantified to match the datelines for "success" with its probabilities. In this regard, economic tools such as cost-benefit studies and modeling methodologies would yield better quantification and predictive results for the environmental managers.

In another case of environmental concern related to land use, local sewer moratoria are adopted to arrest urban development growth. Such moratoria illustrate another failure of environmental management, a failure to balance the land resource with peoples' demands for it. Land use and environmental issues are also tied up with the availability of other resources, such as capital improvements, the priority of placement of limited public services (nee, funds), and the desirability of citizens and residents subsidizing continued growth. These questions have no answers today; the issues and their ramifications are evolving ones.

Historically, environmental crises have focused on endangered species, endangered rivers, and endangered wildreness areas. Other crises have dealt with forest fires and the shortages of timber (both as a lumber commodity and as recreational preservers). Today, energy crises and fuel shortages portend further scarcities. Indeed, one can justifiably cry "wolf" in the consideration of any natural resource, whether it be air, water, land, biological systems, minerals, or energy.

Moreover, an interdependence among natural resources transcends present-day capabilities for environmental management. Too often governmental structures speak to the responsibility for purification of air or water rather than air and water, or the impact of land development on both, as an example. An integration of environmental programs would be a more rational approach. Acknowledgement by governmental officials of these self-evident truths has yet to be reflected in coordinated actions. Unfortunately, again no easy solutions are available.

In addition, such an integrative approach would begin to solve the more arduous decisions of environmental tradeoffs. For example, energy and fuel sufficiency is usually at the cost of other environmental concerns, such as land must be developed to provide production and transmission facilities. Environmental management would expand its scope and mission to assess the full-cost ramifications of one natural resource versus another, of local and regional-area groupings and appropriate balance of resources as a composite picture, of human needs versus purely human desires, and of the realities of the full implications of costs. The really hard work of environmental management is yet to come.

The Manager and the System

Environmental managers, in fairness, cannot anticipate the shifting public mood of these numerous crises--today's hot topic, its degree of urgency, and its longevity. Indeed, the urgencies seem to merge together as one big sustained environmental mass alarm. Nonetheless, each older as well as newer crises and recurrent malfunctioning within our growing metropolitan system seems to occur with greater frequency and shriller intensity, especially because of the quickening urban pace and style of living today and its greater toll on all human and natural resources. More fundamentally, each and every time a crisis occurs it calls attention to the conditions of mismanagement and nonmanagement of urban resources.

However, environmental managers are not totally to blame. Rather, an urban system especially is a shared style of living with interdependencies abounding. Each person depends for his/her needs on the specialties of others. No one stands alone; no one is able to stand alone. Likewise any blame for the malfunctioning of the environment must more realistically be shared by all. Environmental managers are only a part of this broader, total system.

On balance, environmental managers have done something. Judgment cannot be totally one-sided against them. For example, the air and water are being cleaned up. Environmental managers have learned to make better measurements of pollution counts, and they have attacked and usually bettered many of the observed deficiencies. They have come to understand and to appreciate the resource recovery, recycling, and restoration process. They have advanced the use of the environmental impact statement and have engendered a national environmental awareness with its evolution.

Environmental managers have had to function without a clear-cut strategy for governing the environment. Yet, they have not taken a leadership role in the development and promulgation of that strategy. Fractionalized accountability has raised the question of who is responsible for environmental policy. At the other end of the responsibility spectrum, the question is also asked: Who is responsible for environmental damage? In the final analysis environmental managers question their proper role, and their goals, in their concern for the environment--as advocate, protector, regulator, standard-bearer or -setter, enforcer, monitor, benefactor, or janitor.

Environmental Management Summary

In summary, the accomplishments of the EPA Summer Fellows may be presented as follows. The five-person student team formulated a definition of environmental management that delineated a set of activities that they believed to be the proper purview of environmental managers. Literature disclosed that no one had yet attempted this. They offered criteria by which to judge environmental success, and made a conceptual distinction between governmental environmental management and the ordinary activities of citizens. Finally, a prescriptive note was added to the definition by suggesting that the goal of environmental management become envirological management.

Environmental concerns are viewed traditionally as the basic categories of natural resources (or air, water, land, biological systems, minerals, and energy). However, environmental managers need a broader concept of responsibility. Envirological management is this broader concept, or the concept of extensively planning the balancing of the five major competing objectives of human health, economic growth, social growth, ecosystem balance, and lastly, aesthetics or amenities. By managing the environment in such a way that a balance is achieved among the five criteria offered, envirological management is achieved.

Being an environmental manager today simply means that a person has authority over certain, unidimensional programs--perhaps even just one program or function, such as air or water quality. Even so, however, using this authority in such a way as to attain balance among the five criteria noted ultimately accomplishes envirological management.

SECTION VII
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16. Abstract

Twenty-five students who participated as EPA summer fellows were selected from among 800 applicants responding to a national recruitment program. The students chosen majored in a wide range of environmentally related studies on university & college campuses across the U.S. Select research topics were undertaken to bring fresh, hopefully unbiased, viewpoints on existing environmental problems in the anticipation that their contributions would suggest new avenues for the development of current long-range environmental strategy.

The students, composing 5 investigative teams, concentrated their efforts on: a possible approach toward quantifying the concept 'quality-of-life'; development of an accounting system for allocating pollution produced by industry as a result of consumer demands for goods and the environment; investigating the realm of environmental management; and lastly, how the generation of pollution differs as a characteristic of a community's location within large metropolitan areas.

This volume, the first in a series, presents a synopsis of the full length reports published as separate reports in this series. The other reports are: (Vol. 2) Quality of Life; (Vol. 3) Pollution and the Municipality; (Vol. 4) Consumption Differentials and the Environment: (Vol. 5) Outdoor Recreation and the Environment; (Vol. 6) Environmental Management.

17a. Descriptors
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